APP PERMIT ROUTING SLIP

Date February 4, 1999 Hermit Mine

FACILITY International Uranium (USA) Corporation **INVENTORY NO.** 100299

USAS/SITE CODE NO. 50015900

APPROVAL PROCESS

1. Project Officer Craig Deckert

(Check items below when completed)

- X executive summary
- N/A copy of public notice
- N/A affidavit of public notice
- N/A draft permit
- N/A responsiveness summary (or X not needed)
- X project tracking database updated and complete
- X consistent with current boilerplate
- X spell checked
- X proofread

Comments:

Initial	Date
C.D.	2/4/99

2. Unit Manager

(Check after each item has been reviewed for completeness, conciseness, clarity, logical approach, grammar, spelling)

- ✓ executive summary
- ✓ regulatory status
- ✓ facility description, including description of discharges and treatment train
- ✓ BADCT description
- ✓ monitoring approach, constituents and reporting
- ✓ database entries complete

Comments:

Initial	Date
DLT	2/9/99

SIGNATURE PROCESS

3. Project Officer

(initial and date when complete)

- X revisions made (or ___not needed)
- X final permit printed (2 copies)
- X final executive summary printed (2 copies)
- X project tracking database updated
- X payment notification received

Comments:

Initial	Date
C.D.	2/11/99

4. Unit Manager DENNIS L. TURNER

(initial and date at final approval)

Initial	Date
DLT	2/16/99

5. Troy Day, Water Permits Acting Manager

(initial and date at final approval)

Initial	Date
TD	2/23/99

6. Karen L. Smith, Water Quality Director

(initial and date at final approval)

Initial	Date
KLS	2/25/99

7. Project Officer

(initial and date when complete)

- X final permit sent to facility
- X copy of permit to Administrative Assistant
- X copy of permit and executive summary to Compliance
- X copies to distribution list
- X permit electronically archived (j:\app\permits\complete)
- X project tracking database updated

Comments:

Initial	Date
C.D.	3/2/99

NET CYCLE TIME: 33 **Days (as of** 3/2/99**)**

TRACKING RECORD ~~592~~ 661

1 FILE # 87-115
2 FACILITY NAME Hermit Mine
3 FACILITY NAME2 / Energy Fuels
4 NOD REC DATE 6/15/87 5 PERMIT TYPE 4W 6 PERMIT # G-0035-07
7 COUNTY CODE 08 8 PRELIM REV _____ 9 WHO DID PRELIM CR
10 FACILITY TYPE Uranium Mine/
11 DISPOSAL METH Lined Surface Pond
12 LTR OF INTENT 9/2/87 13 ADD INFO REQ tele 7/28/87 14 INFO REC DATE 9/2/87
15 INFO REQUESTED rec. 8/31/87
16 INFO REQUESTED _____
17 PERMIT APP REQ _____ 18 PERMIT APP REC _____
19 HYDRO REVIEW ~~8/4/87~~ 7/9/87 20 FILE RETURN 8/4/87
21 DRAFT PERMIT 9/2/87 22 PERMIT WRITER Carol Russell Rugul
23 INTERNAL BEGIN 9/30/87 24 INTERNAL ENDS 9/30/87
25 EXTERNAL BEGIN 10/30/87 26 EXTERNAL ENDS 10/30/87
27 PUBLIC NOTICE 9/4/87 28 PN ENDS 10/4/87 29 REVISIONS 12/29/87
30 PUBLIC HEARING _____ 31 SENT FOR SIGN 12/9/87 32 DATE SIGN ~~1/8/88~~
33 COMMENT _____
34 COMMENT _____
35 COMMENT _____

MEETING AGENDA

ADEQ-WPS-MU AND INTERNATIONAL URANIUM (USA) CORPORATION
TUESDAY, NOVEMBER 10, 1998

1:00 - 1:10 Introductions and Opening Comments

1:10 - 1:30 Kanab North Mine 100069

IUC Status Update
ADEQ APP Application
General Discussion

1:30 - 1:50 Hermit Mine 100299

IUC Status Update
ADEQ Closure Requirements
General Discussion

1:50 - 2:10 Pinenut Mine 100300

IUC Status Update
ADEQ APP Application Status
General Discussion

2:10 - 2:30 Canyon Mine 100333

IUC Status Update
ADEQ APP Application Status
General Discussion

2:30 - 3:00 Meeting Summary and Wrap Up

Decisions
Action Items
Schedules

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION

WATER PERMITS SECTION
3033 North Central Avenue
Phoenix, Arizona 85012

FAX NUMBER (602) 207-4674

DATE: November 9, 1998

TO: Michelle R. Rehmann

FAX NUMBER: (303) 389-4125

PHONE NUMBER: (303) 389-4131

FROM: Craig DeWalt - Aquifer Protection Project Officer

PHONE NUMBER: (602) 207-4789

PAGES: Cover Sheet + 1

COMMENTS: General Agenda Outline Please call if any comments.

IF YOU HAVE ANY PROBLEMS WITH RECEIVING THIS FAX
PLEASE CALL: (602) 207-4675

Visit ADEQ Online

http://www.adeq.state.az.us

Contact information * Printable forms & reports * Program descriptions *
Environmental links * Downloadable guidance documents

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION

WATER PERMITS SECTION
3033 North Central Avenue
Phoenix, Arizona 85012

FAX NUMBER (602) 207-4674

DATE: November 9, 1998

TO: Mr. Roger Smith

FAX NUMBER: (520) 643-7328

PHONE NUMBER: (520) 643-7321

FROM: Colin DeWalt - Aquifer Protection Project Officer

PHONE NUMBER: (602) 207-4789

PAGES: Cover Sheet + 1

COMMENTS: Renewal Agenda Outline Please call if any comments

IF YOU HAVE ANY PROBLEMS WITH RECEIVING THIS FAX
PLEASE CALL: (602) 207-4675

Visit ADEQ Online
http://www.adeq.state.az.us

Contact information * Printable forms & reports * Program descriptions *
Environmental links * Downloadable guidance documents

11/10/98

Canyon Mine

* New financial capability demonstration needed.
* We need to review & confirm analytical data. ≤ 4 from all waters
* 6/13/95 - Signed final decision & order by ADEQ director Fox orders issuance of GWQPP#G-0004-03.
* This occurred 6/93 w/o original due date after receipt of APP application in 12/93.
* 4/3/94 - Application deemed Admin. complete.
* 4/12/95 - Request for added info - technical review.
* Require 90 day notice before operations commence.
* Require confirmation of pond stability, ore pad, etc.
* Public comment will occur again.
* Possible reduction in sampling if confirmation of aquifer flow is down gradient from operations and the well will intercept before seepage.
* Water intrusion? → ∅ Yes — May need revised maps.

No adverse impact on groundwater quality

(970) 677-2726

R. Smith
IUC Kanabe
(520) 643-7321

12/13/93 APP submitted w/check for $3,650

APP submitted w/check for $5,900.00 on 1/5/95

Canyon Mine **International Uranium corp was a subsidiary of Energy Fuels**

International Uranium Corporation #100333

* NOD 1985
* GWQPP # GO004-03 1988
* Restricted to mine-water and stormwater runoff to a lined impoundment.
* Monitoring - Pre-Mining - aquifer shall be sampled at well #55-515772 quarterly. Regional aquifer also to be sampled at Havasu Indian Garden and Blue Springs. → Has to get permit → Has to get multiple authorities - Helicopter
* Mining - monitor well #55-515772 quarterly
* Mine inflow quarterly * Post-mining # 55-515772 semi-annually for 15yrs.
* Closure is referenced in Section 2.5.2 of the Final Environmental Impact Statement & Exhibit C of the NOD

Can't find Exhibit C on 2.5.2 refers to Plan of Operations App. A, App. B

* 1994 letter from ADEQ to EFN states that review of the APP permit application seems submittal complete.
* 3-3-97 MU97:0066 states it is a fully permitted underground uranium mine.
* 1995 letters to Mike Wood to not permit the mine. Many requests to be placed on mailing list for any permit issues.

APP

dft APP - 90 days notice before operating

* 8/94 ADEQ memo from M. Greenslade (P.E.) to M. Wood (P.O.) stated technical review was performed and listed inadequacies.
* A 4/4/95 draft letter was prepared by M. Wood to request additional technical information.
* A draft Hydrologic Review was prepared on 2/14/95. Unclear who performed the review.
* MU95-0115 4/12/95 - Request to EFN from ADEQ (M. Woods) for additional technical info.

11/10/98

Kanab North Mine

* APP application pending. $6,000.00
* LTF
*
* Has mine operated? No
*
*
→ They will discuss if want to close per GWQPP
→ Kanab is undecided
11/30/98 SD. → Will proceed with APP application

Kanab North Mine

International Uranium Corporation - #100069

3/3/97 - MU97:0046 - Written notification that 4/30/96 was early in date. WPS-MU grants EFN extension to submit APP within 120 days after effective permit transfer date ~ 4/18/97.

* In GWQPP - Authorized to dispose only water pumped from the mine & surface water runoff from disturbed area of the mine to a synthetic or natural clay lined holding pond.

* NPDES Permit # AZ 0022322. *NOD

* GWQPP Permit # G-0007-08

* BLM - 1984 = Clean mine yard - Radiometric survey
Seal all mine entrances - Reclaim disturbed areas.

* ADEQ 11/19/92 inspection - no deficiencies.

* BLM - could not find anything regarding the holding pond.

will check file →

11/9/98

Pinenut Mine

"Operated as a non-discharging facility" → we will review technically → BADCT
1.) Low quantity of water encountered
2.) quality of water influenced by other area mines
→ Need Alert levels still
→ 3.) Operational Controls Utilized
4.) Site Characteristics of low permeability rock below deepest extent of mine
→ Existing Facility ARS 49-201.14
→ Presumptive Controls Prescriptive

* Last submitted was 12/15/95 - still administratively incomplete - in need of financial capability
* Has the mine operated?
* Is other APP application info still valid?
* Require 90 day notice before operating. - Inspection of ponds, etc
* Request they provide written request for reduction or elimination of pre-mining monitoring
* APP to indicate an amended closure plan to include details of sealing the mine.
* Mining depth not to exceed 1,500' in GWQPP
* POC - Well # 55-513394 - Where is location? >6.5 miles according to APP application. - limit of PMA. vertical plane down gradient of the facility
* Redwall - Muav Limestone Formation is the only known regional aquifer in the area. Some 1,160' below the lowest point in the mine workings or shaft.
* On Appendix VIII site plan, the containment pond is described as a "discharge facility"
* Where are the waste rock and ore pad areas?
* What is actual capacity of the pond? → →
* There may be a revised list of mining and post mining monitoring parameters.
* Have any AWQS exceedences been reported?
* Photo of the site.
* Public Notice - ?
* Alert Demonstration?
* Financial capability

Compliance Schedule

10/23/98

Pinenut mine

International Uranium Corporation

* There is a Drainage Plan Proposal from Charles Leaf ~ 4/86.
* 10/28/86 - Water well total depth 3,200' below ground surface - static water level 2,494' below well collar elevation.

Perched intercept: 2,460'
Casing to 2,524' grouted to 900' Started dewatering 2 years before production - suggests perched water higher up

* Pinenut mine will be approximately 1,360' ~~deep~~ below ground elevation. That places static water level of the water well ~ 1,134' below the mine workings.
* Pinenut Mine - 7/23/87 - NOD 86-55 NOD lists Drawing # PN-AA8-13 Evap. Pond Design 4.8 acre feet.
* Plan of Operations - Jan. 1986
* 4/8/86 - Charles Leaf Holding Pond Capacity calcs.
* ** Need construction details. PNAA8-13 has no details.
* Provide installation QA/QC Plan as described in E.S.A. of APP application. And F.S.D.2.

found in APP app. Still doesn't list materials used, ie clay

* Page 15 of APP app. Closure - we need more precise info on how it will be sealed - type of materials - more detail.
* Can they follow the closure listed in the GWQPP or need to update per APP requirements for closure? Can we use GWQPP and then the 180 day notice & update per APP closure requirements?

Pinenut ~~Mine~~ Mine

International Uranium Corporation #100300

* GWQPP # G-0036-08-1988 - Restricted to mining water and runoff to a lined impoundment. Regional aquifer to be sampled (Pre-mining) at monitoring well # 55-513394 Post-Mining Well #55-515772 & Willow Springs for 15 yrs.
* NOD 3/17/87 This well is at Canyon Mine, on other side of Grand Canyon
* During mining - well #55-513394 quarterly and annually for different parameters. Mine inflow monitoring. Monitor Willow Springs
* Closure plan with the BLM is referenced.

* No analysis reports since 1991 - Found in 1995 APP to 10/26/94 submitted
* APP submitted 7/18/95 w/ $5,900.00 fee 7/21
* 8/95 - ADEQ notifies administratively incomplete
* 8/95 - EFN requests 60 days to be added to 9/28/95 due date for added info
* 8/95 - ADEQ O.K.'s extension to 11/27/95
* 11/14/95 - EFN requests added extension per phone, ADEQ O.K.'s to 12/22/95
* 12/15/95 - EFN provides added info - Last correspondence to Mr. Mike Wood
* 1/29/96 letter from Mohave County gives zoning O.K.
* Financial was to be submitted under separate cover

Admin Review 10/22

* Still need R-18-9-108.B.8.a
  R-18-9-108.B.8.b
  R-18-9-108.B.8.c
  > Ask if all other information is still accurate.

Add

* If APP - 90 day notice before operating
* Have Mr. Smith provide request in writing to eliminate

Proof Of Publication

STATE OF ARIZONA,
County of Mohave } ss.

GERALD DAVIS, being first duly sworn, says that during the publication of the notice, as herein mentioned, he was and now is the Publisher of the MOHAVE VALLEY NEWS, twice weekly newspaper published on Wednesday and Friday of each and every week at the town of Bullhead City, in said county.

That said newspaper was printed and published as aforesaid on the following dates, to-wit:

SEPTEMBER 16 19 87
SEPTEMBER 23 19 87
....., 19.....
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That the NOTICE OF INTENT TO ISSUE

of which the annexed copy is a printed and true copy, was printed and inserted in each and every copy of said newspaper printed and published on the dates aforesaid, and in the body of said newspaper and not in a supplement thereto.

Gerald D. Davis

Subscribed and sworn to before me this 18 day of Nov., 1987

Sandra K. Whitacre
Notary Public
MY COMMISSION EXPIRES 10-28-90
(My commission expires .....)

Public Notice No. 94-87AXGW
Energy Fuels Nuclear
Hermit Mine
One Tabor Center
Denver, Colorado 80202
T38, R 4 W, Section 17, W ½, SW ¼
Groundwater Quality Protection
Permit No. G-0036-08

The applicant, Energy Fuels Nuclear, Inc., has proposed to operate the Hermit Mine located approximately 21 miles south of Fredonia, Arizona in Mohave County. The facility will consist of mine workings to a depth of approximately 1,500 feet and a 23-acre surface operations area. The facility will be constructed as a zero discharge facility except for a septic system for disposal of typical domestic wastes. All water pumped from the underground and all runoff from the surface facility shall be directed to a line surface impoundment and storm water will be diverted around the facility. All water containment and diversion structures shall be designed, constructed and maintained to control waters from no less than a 100-year, 24-hour precipitation event.

AND

Public Notice No. 95-87AZGW
Energy Fuels Nuclear
Pinenut Mine
One Tabor Center
Denver, Colorado 80202
T 36 N, R 4 W, Section 21 NW ¼, SW ¼
Groundwater Quality Protection
Permit No. G-0036-08

The applicant, Energy Fuels Nuclear, Inc., has proposed to operate the Pinenut Mine located approximately 51 miles south of Fredonia, Arizona in Mohave County. The facility will consist of mine workings to a depth of approximately 1,500 feet and a 15-acre surface operations area. The facility will be constructed as a zero discharge facility except for a septic system for disposal of typical domestic wastes. All waters pumped from the underground and all runoff from the surface facility shall be directed to a lined surface impoundment and storm water will be diverted around the facility. All water containment and diversion structures shall be designed, constructed and maintained to control waters from no less than a 100-year, 24-hour precipitation event.

The permit (application)(Notice of Disposal) is available for public review Monday through Friday, 8:00 a.m. to 5:00 p.m. at Arizona Department of Environmental Quality, Permits Unit, 2005 North Central Avenue, Phoenix, Arizona 85004.

Persons may submit comments or request a public hearing on the proposed action, in writing, to ADEQ at the above address within thirty (30) days from the date of this notice. Public hearing request must include the reason for such request.

Publish September 16, 1987w

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
P.O. Box 488, Phoenix, Arizona 85001-0488, Phone (602) 257-2310 (800) 234-5677, ext. 2310

Annual Registration Fee Invoice

Aquifier Protection Permit, Groundwater Quality Protection Permit or Notice of Disposal

To: Energy Fuels-Hermit Mine
P.O. Box 36
Fredonia, AZ 86022

Please return to:
Arizona Department of Environmental Quality
Accounts Receivable
P.O. Box 488
Phoenix, AZ 85001-0488

RECEIVED DEC 16 1991

ID Number: 100299

Period: 01/01/91 - 12/31/91

Payment Due Date: 12/13/91

Instructions for completing this form are on the back. Check the box that represents your facility category, determine and enter the daily discharge/influent of pollutants, and enter the respective registration fee:

Facility Category	Discharge/Influent (gallons per day)	Registration Fee
☐ Injection Well		
☐ Land Treatment Facility		
☐ Dry Well		
☐ Septic Tank with capacity of more than 2,000 gal/day		
☐ Facilities which discharge in navigable water		
☒ Surface Impoundment	less than 1000 g/day	0
☐ Facility which adds a pollutant to a salt dome formation, underground cave or mine		
☐ Mine Tailings Pile or Pound		
☐ Mine Leaching Operation		
☐ Sewage or Sludge Pond		
☐ Wastewater Treatment Facility		
☒ Discharge less than 2,000 gal/day		
☐ Not Subject to ARS § 49-242		
	Amount Enclosed	$ 0

I hereby certify that the above information is true and correct to the best of my knowledge:

Signature: Donna M. Pellmore

Check your address as printed above, and provide corrections if necessary:

Retain the pink copy for your records. Return the completed signed original and the yellow copy of the form with your remittance payable to the Arizona Department of Environmental Quality.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
AQUIFER PROTECTION PERMIT
PROCESSING FEE INVOICE

COPY

* Pursuant to A.R.S. § 49-113, effective July 1, 1996, "The director shall collect interest on the unpaid amount of every payment, fee, self reported fee, tax, assessment, cost and penalty authorized by this title ... from the date required for payment until the full amount is paid. If nonpayment is due to wilful neglect, the director shall also collect an additional five per cent penalty of up to twenty-five per cent of the amount due for each month or fraction of a month the amount is past due."

If you have any questions about this invoice, call
Craig DeWalt at (602) 207-4789
or toll-free within Arizona at (800) 234-5677, extension 4789

Inventory Number: 100299	Invoice Number: 51597
To: International Uranium USA Corp 2555 N Highway 89A HC 64 Box 153 Fredonia, AZ 86022	Permit Number: Period Covered: 09/21/1998 - 02/05/1999 Due Date: **March 11, 1999**
LTF-Id #: 10606	Total Amount Due . . . . . $ -11.00 Amount Paid . . . . . $

↑ Keep the top portion for your records. ↑

↓ This entire bottom portion must be returned to ADEQ. ↓

Page 1 of 1 **Aquifer Protection Permit** **Invoice #** 51597

International Uranium USA Corp 2555 N Highway 89A HC 64 Box 153 Fredonia, AZ 86022	Hermit Mine
LTF-Id #: 10606	Inventory Number: 100299 **APP** Period Covered: 09/21/1998 - 02/05/1999 Due Date: **03/11/1999**

	Hours	X Rate	= Total
Aquifer Protection Permit			
Time incurred prior to receipt of application for permit or approval	12.50	49.0000	612.50
Technical completeness review	18.50	49.0000	906.50
Aquifer Proteciton Permit Clean Closure			
Administrative completeness review	10.50	49.0000	514.50
Technical completeness review	1.00	49.0000	49.00
Drafting of permit/approval/modification/extension	18.50	49.0000	906.50

AMOUNT DUE.	$ 2,989.00
Plus Paid Interest Charges and/or Other Adjustments	$ 0.00
Plus Unpaid Interest Charges as of 02/09/99 (accruing at the rate of $0.0000 per day)	$ 0.00
Minus Payments Received and/or Other Adjustments	$ 3,000.00
Total Balance Due (Please make check payable to **State of Arizona**)	$ -11.00
Amount received by ADEQ	$

* A $12 fee will be charged for any check not honored by the bank.

Make your check or money order payable to **State of Arizona**
THIS FORM MUST ACCOMPANY YOUR REMITTANCE.

Mail to: Arizona Department of Environmental Quality
P.O. Box 618
Phoenix, AZ 85001-0618

Do not write below this line

Check Number:	
Received:	
Postmarked:	500159-00
Entered:	CJB 02/09/1999 IB205Post

INITIAL FEE ____ \ REQUEST FOR BILLING X

Program Name: APP
Site Code: 500159-00
Site Code Verified in USAS: 98-661
Construction File Number: ____

Date: ~~1/11/99~~ C.D. 2/8/99
Inventory #: 100299
Landfill #: ____
Account#: ____

Facility/Project Name: International Uranium Corporation - Hermit Mine
Facility/Project Address: ____
(Line 2) ____
(Line 3) ____
Billing Name: International Uranium (USA) Corporation
Billing Address: 2555 N. Highway 89A
(Line 2) H.C.64, Box 153
(Line 3) Fredonia, Arizona 86022
Contact Person Donn M. Pillmore Telephone (520) 643-7321 Ext ____ Fax (520) 643-7328

Application/Initial Fee: Date Rec'd 12/24/98 Check# 221 Amount: $3,000.00
(**ALWAYS** attach a copy of the CHECK or RECEIPT)

ATC-PR ____	APP X	WCI-PI ____	SWA ____	PPA ____	HWP ____
ATC-SA ____	WPC ____	WCI-FI ____	SWE ____	VOL ____	HWM ____
AOC-SA ____	WPR ____	WCI-RP ____	SWP ____	WQE ____	HWC ____
AOC-DR ____	WRP ____				

ADEQ Personnel with Billable Hours who worked on this Site:

Period Covered: From: 9/21/98 Through: ~~1/29/99~~ C.D. 2/5/99

Name: ____ Ext: ____ Name: ____ Ext: ____
Name: Jay Das Ext: 4592 Name: ____ Ext: ____
Project Officer: Craig DeWalt Ext: 4789 Date: ____
Unit Manager: Dennis Turner Ext: 4663 Date: ____
Comments: Revised period covered to 2/5/99 as I put in 3.0 hrs. more on this site. They will show on my next time card as Act. Code 8064 and sub activity code 8114.

PLEASE CIRCLE (O) THE CORRECT BUSINESS TYPE:

I - Native American Owned Entities F - Federal Government S - Satate Government C - County Government
M - Municipal (City) Government D - Districts (O - Other)

For Cost Recovery Use Only:

	Hours	Activity Code	Sub-Activity Code
Processing Cost Breakdown Attached:	____		
Final Adminstrative Processing	____	____	____

Total Hourly Rate $49.00 X Hours: ~~58.0~~ 61.0 C.D. = $~~2,842.00~~ $2,989.00 C.D.

Project Officer Signature Craig DeWalt Date ~~2/5/99~~ 2/8/99

Unit Manager

OK to Bill? Yes ____ No ____ Ok to Refund? Yes ✓ No ____

Signature: Dennis L. Turner Ext: 4663 Date: 2/4

INITIAL FEE ____ \ REQUEST FOR BILLING X

Program Name: APP
Site Code: 500159-00
Site Code Verified in USAS: 98-1661
Construction File Number: ____

Date: ~~2/4/99~~ C.D. 2/8/99
Inventory #: 100299
Landfill #: ____
Account#: ____

Facility/Project Name: International Uranium Corporation - Hermit Mine
Facility/Project Address: ____
(Line 2) ____
(Line 3) ____
Billing Name: International Uranium (USA) Corporation
Billing Address: 2555 N. Highway 89A
(Line 2) H.C 64 Box 153
(Line 3) Fredonia, Arizona 86022
Contact Person Donn M. Pillmore Telephone (520) 643-7321 Ext ____ Fax (520) 643-7328

Application/Initial Fee: Date Rec'd 12/24/98 Check# 221 Amount: $3,000.00
(**ALWAYS** attach a copy of the CHECK or RECEIPT)

ATC-PR ____	APP X	WCI-PI ____	SWA ____	PPA ____	HWP ____
ATC-SA ____	WPC ____	WCI-FI ____	SWE ____	VOL ____	HWM ____
AOC-SA ____	WPR ____	WCI-RP ____	SWP ____	WQE ____	HWC ____
AOC-DR ____	WRP ____				

ADEQ Personnel with Billable Hours who worked on this Site:

Period Covered: From: 9/21/98 Through: ~~1/29/99~~ C.D. 2/5/99

Name: ____ Ext: ____ Name: ____ Ext: ____
Name: Jay Das Ext: 4592 Name: ____ Ext: ____
Project Officer: Craig DeWalt Ext: 4789 Date: ____
Unit Manager: Dennis Turner Ext: 4663 Date: ____
Comments: Revised period covered to 2/5/99 as I put in 3.0 hrs. more on this site. This will show on my next time card as Act. Code 8064 and sub activity code 8114.

PLEASE CIRCLE (O) THE CORRECT BUSINESS TYPE:

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M - Municipal (City) Government D - Districts (O - Other)

For Cost Recovery Use Only:

	Hours	Activity Code	Sub-Activity Code
Processing Cost Breakdown Attached:	____		
Final Adminstrative Processing	____	____	____

Total Hourly Rate $49.00 X Hours: ~~58.0~~ 61.0 C.D. = $~~2,842.00~~ $2,989.00 C.D.

Project Officer Signature Craig DeWalt **Date** 2/5/99 2/8/99

Unit Manager

OK to Bill? Yes ____ No ____ Ok to Refund? Yes ____ No ____

Signature: ____ Ext: ____ Date: ____ PM 2/4

CTF-100616

INTERNATIONAL URANIUM USA CORP 05/97

2555 N HIGHWAY 89A
HC 64 BOX 153 520-643-7321
FREDONIA, AZ 86022

WATER PERMITS

DEC 24 1998

RECEIVED

221

December 4, 19 98

31-5/1240
52

PAY TO THE ORDER OF Arizona Department of Environmental Quality $ 3,000.00

The sum of $3,000 and 00 cts DOLLARS

ZIONS BANK
Zions First National Bank
Kanab Office 41 East Center Street
Kanab, Utah 84741

FOR Hermit Mine Clean Closure Review Fee

Roger B. Smith MP

⑈000221⑈ ⑆124000054⑆ 052 01233 3⑈

©CLARKE AMERICAN BA
GUARDIAN ● SAFETY

IUC INTERNATIONAL URANIUM (USA) CORPORATION

Donn M. Pillmore

H.C. 64
Box 153
2555 No. Highway 89A
Fredonia, AZ 86022

520 643 7321 (phone)
520 643 7328 (fax)

Initial Fee for Clean Closure of
IUC Hermit Mine
Inventory No.: 100299
Site Op No: 50015900

Check was given to Anna Downstairs to be put in safe

=>

02/04/99 SITE 50015900 PAGE 1
15:11:45 LABOR HOURS 09/21/98 TO 01/29/99 DETAIL

EMPLOYEE NAME		PPE DATE	INDEX	PCA	ACT	SUB ACT	HOURS
DAS, JAYANTA	1104 EX	19981120	82700	47101	8061	8111	0000300
COUNT PPE DATE	1						
DEWALT, CRAIG	0724 NE	19981023	82400	47101	8061	8111	0000400
		19981106	82400	47101	8061	8111	0000350
		19981120	82400	47104	8061	8111	0000200
		19981204	82400	47104	8064	8113	0000250
		19981218	82400	47101	8064	8113	0000050
		19990101	82400	47101	8064	8112	0001050
		19990115	82400	47101	8064	8113	0001550

MORE ....

<PF1> HELP <PF2> RETURN <PF3> TOTALS ONLY <PF4> DETAIL
<PF5> NO TOTALS <PF6> STATS <PF7> BACKWARD <PF8> FORWARD
<PF9> GRAPH <PF10> SEND <PF11> LEFT <PF12> RIGHT

8061

8111
3.0
4.0
3.5
2.0
12.5

8061
8113
2.5
.5
15.5
18.5

8064
8112
10.5

12.5
18.5
10.5
15.5
1.0
58.0
x $49.00
$2,842.00

plus 3 hrs. for week ending 2/5/99 =
3 x $49.00 = $147.00

Total = $2,989.00
C.D. 2/8/99

=>

02/04/99 SITE 50015900 PAGE 2
15:11:45 LABOR HOURS 09/21/98 TO 01/29/99 DETAIL

EMPLOYEE NAME	PPE DATE	INDEX	PCA	ACT	SUB ACT	HOURS
DEWALT, CRAIG 0724 NE	19990115	82400	47101	8064	8114	0000800
	19990129	82400	47101	8064	8114	0000750
	19990129	82400	47101	8064	8113	0000100

COUNT PPE DATE 10

COUNT PPE DATE 11

---------- LAST PAGE ----------

<PF1> HELP <PF2> RETURN <PF3> TOTALS ONLY <PF4> DETAIL
<PF5> NO TOTALS <PF6> STATS <PF7> BACKWARD <PF8> FORWARD
<PF9> GRAPH <PF10> SEND <PF11> LEFT <PF12> RIGHT

8064

8114
8.0
7.5
15.5

8113
1.0

STATE OF ARIZONA

TIMESHEET PROFILE

PREPARED BY:	AGENCY:	PHONE:	PM-SO5A
Craig DeWalt	Department of Environmental Quality		
AUTHORIZED BY:	DATE: / ENTERED BY: (HRMS) / DATE	ENTERED BY: (LABOR) / DATE	

AGY	INDEX	EMP CLASS	EMP NO	BEGIN PAY PER	END PAY PERIOD	PAGE	TOT PGS	HB INDEX
EVA	99991	001	[redacted]	01/16/99	01/29/99	01		82400

NAME (30) (LAST, FIRST, MIDDLE INITIAL)	TOTAL HOURS	COMP TIME	OVER TIME
DEWALT, CRAIG 0724 NE			

HRMS

PAYROLL USE ONLY	PCA	HOUR TYPE	HRMS	TOTAL	S	S	M	T	W	T	F	S	S	M	T	W	T	F
		HOURS WORKED		66.5				8.0	8.0	8.0	8.0			8.0	8.0	2.5	8.0	8.0
	01210	ANNUAL LEAVE	VT															
	01220	SICK LEAVE	ST															
	01220	FAMILY SICK	FT	5.5												5.5		
	01230	HOLIDAY	HT	8.0			8.0											
	01240	MILITARY LEAVE	MT															
	01250	BEREAVEMENT LEAVE	BT															
	01260	ADMINISTRATIVE LEAVE	AT															
	01270	JURY DUTY	DT															
	01300	COMP TIME USED	CT															
		SHORT TERM LEAVE W/O PAY	LW															
		PAY PERIOD TOTALS		80.0			8.0	8.0	8.0	8.0	8.0			8.0	8.0	8.0	8.0	8.0

LABOR DISTRIBUTION

HOURS (4)	TYPE (2)	HB (1)	AY (2)	INDEX (5)	PCA (5)	GRANT / PH (8)	SITE/OP UNIT (8)	ACT (4)	SUB (4)	REF (6)	S	S	M	T	W	T	F	S	S	M	T	W	T	F
																						n.d.		
19.5	RG	N	99	82400	47104	Admin	—	8012	—					1.0	2.5	1.0	1.5			1.5	3.5	[redacted]	7.0	1.5
1.5	"	"	99	82400	47101	Admin	—	8012	—						0.5		0.5				0.5			
1.0	"	"	99	82400	47101	50015900	IUC Hermit	8064	8113					1.0										
7.5	"	"	99	82400	47101	IUC Hermit	50015900	8064	8114					6.0	1.0						0.5			
6.0	"	"	99	82400	47104	IUC Pinenut	50016000	8051	8113						4.0		0.5			1.5				
17.0	"	"	99	82400	47101	IUC Kanab	08005000	8061	8112							6.5	4.0			1.0	1.0	2.5		2.0
3.0	"	"	99	82400	47101	PD CTSA	02016000	8051	8113							0.5					2.5			
1.5	"	"	99	82400	47101	AMT Copper	11014601	8081	—								1.5							
4.0	"	"	99	82400	47101	Cyprus TB	10022100	8061	8112											4.0				
3.5	"	"	99	82400	47101	Cyprus TB	10022100	8064	8113														1.0	2.5
2.0	↓	↓	99	82400	47101	IUC Canyon	03003200	8051	8114															2.0
66.5	HOURS WORKED												0.0	8.0	8.0	8.0	8.0			8.0	8.0	2.5	8.0	8.0

I certify that the hours recorded represent, to the best of my knowledge, an accurate record of the time that I have devoted to the identified programs/activities per state and federal policies and procedures.

Employee's Signature Craig DeWalt

Supervisor's Signature Dennis L. Tanner

GAO PM-SO5A (REV. 9-17-92) TIMESHEET PROFILE (COMPUTER PRINTED)

STATE OF ARIZONA

TIMESHEET PROFILE

PREPARED BY:	AGENCY: Department of Environmental Quality			PHONE:	PM-SO5A
AUTHORIZED BY:	DATE:	ENTERED BY: (HRMS)	DATE	ENTERED BY: (LABOR)	DATE

AGY	INDEX	EMP CLASS	EMP NO	BEGIN PAY PER	END PAY PERIOD	PAGE	TOT PGS	HB INDEX
EVA	99991	001	[redacted]	01/30/99	02/12/99	01		82400

NAME (30) (LAST, FIRST, MIDDLE INITIAL)	TOTAL HOURS	COMP TIME	OVER TIME
DEWALT, CRAIG 0724 NE			

HRMS

PAYROLL USE ONLY	PCA	HOUR TYPE	HRMS	TOTAL	S	S	M	T	W	T	F	S	S	M	T	W	T	F
		HOURS WORKED																
	01210	ANNUAL LEAVE	VT															
	01220	SICK LEAVE	ST															
	01220	FAMILY SICK	FT															
	01230	HOLIDAY	HT															
	01240	MILITARY LEAVE	MT															
	01250	BEREAVEMENT LEAVE	BT															
	01260	ADMINISTRATIVE LEAVE	AT															
	01270	JURY DUTY	DT															
	01300	COMP TIME USED	CT															
		SHORT TERM LEAVE W/O PAY	LW															
		PAY PERIOD TOTALS																

LABOR DISTRIBUTION

HOURS (4)	TYPE (2)	HB (1)	AY (2)	INDEX (5)	PCA (5)	GRANT / PH (8)	SITE/OP UNIT (8)	ACT (4)	SUB (4)	REF (6)	S	S	M	T	W	T	F	S	S	M	T	W	T	F
			99	82400	47104																			
3.0			99	82400	47101	IUC Hermit	50015900	8064	8114						1.5		1.5							
	HOURS WORKED																							

I certify that the hours recorded represent, to the best of my knowledge, an accurate record of the time that I have devoted to the identified programs/activities per state and federal policies and procedures.

Employee's Signature Craig DeWalt 2/8/99

Supervisor's Signature _____

100299

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

License Application Information Cover Form

12-30-98 A08:41 OUT

This form provides basic information needed to expedite the processing of applications for a license subject to A.R.S. 41-1072.* After completing this form, please send it along with all other necessary application components, including the minimum filing fee if required, to:

License Application Receiving
Arizona Department of Environmental Quality
Mail Stop XXXX
3033 N. Central Ave.
Phoenix, AZ 85012-2801

12-29-98 P03:20 IN

* for information or assistance in completing this form, including determining when this form may be sent to one of the ADEQ regional offices, please call: License Application Receiving: 602/207-XXXX or e-mail: xxxx@ev.state.az.us

<<<SEE INSTRUCTIONS ON REVERSE SIDE>>>

1: License Category-ID and Description being applied for (from License Category Tables):	1382	Mine facility AP closure plan approval,

2: Primary Contact NAME: (contact authorized to receive all notifications)	Last name: Pillmore		First name: Donn	
	Middle Initial: M.	Suffix:	Known as:	
Primary contact mailing address:	Street address: H.C. 64, Box 153, 2555 No. Highway 89A			
	City: Fredonia	State: AZ	Zip code (+4): 86022 -	
Other primary contact information:	Phone number: (520) 643-7321		Fax number: (520) 643-7328	
	E-mail ID:		Is this the billing address? Yes or (No)	

If the license being applied for is not an occupational license, please fill out Sections 3 & 4.

3: Applicant FULL NAME: (Normally business/organization name)	International Uranium (USA) Corporation (Formerly: Energy Fuels Nuclear)		
Applicant mailing address:	Street address: Independence Plaza, Suite 950, 1050 Seventeenth St.		
	City: Denver	State: CO	Zip code (+4): 80265 -
Other applicant contact information:	Phone number: (303) 628-7798	Fax number:	
	E-mail ID:	Is the the billing addrss? (Yes) or No	

4: Property/Site name:	Site (Hermit Mine)
Current or prior alias ("known as"):	(International Uranium Corporation / Hermit Mine)

Site location information: please fill out all the bold elements of at least one box

Actual or anticipated Physical address AND/OR	Street address: _____ County: Mohave
	City: _____ State: _____ Zip code (+4): _____ - _____
Latitude/longitude AND/OR	Latitude: N 36° degrees 41' minutes 25" seconds
	Longitude: W 112° degrees 45' minutes 03" seconds
Directions from nearest town (include mileposts where applicable) or cadastral location:	Nearest town: Fredonia
	Driving directions: 21 miles south of Fredonia.
	Township: 38 N Range: 4W Section: 17 Qtr 1: W½ Qtr 2: SW¼ Qtr 3: _____

DO NOT WRITE IN THIS SECTION: (This section for ADEQ use	☐ AIR	☒ WATER	☐ WASTE	☐ SAF	☐ NRO	☐ SRO	☐ VEI			
Contact Name: Craig DeWalt	Location: 435	USAS # Needed: Y or N	N	USAS #:	500159	00				
Check #: 221	Check Amt: 3,000.00	Received By: M Seibold	LTF-ID #: 10606 A							
Other ADEQ Idenifiers: INV. # 100299										

I-38-9

LTF 10606

INIT , FEE X \ REQUEST FOR BIL' 'G

Program Name: WPS
Site Code: 500159-00
Site Code Verified in USAS:
Construction File Number:

Date: 12/28/98
Inventory #: 100299
Landfill #:
Account#:

Facility/Project Name: INC: Hermit Mine
Facility/Project Address:
(Line 2) Fredonia Az 86202
(Line 3)
Billing Name: International Uranium (USA) Corp
Billing Address: 2555 N. Hwy 89A
(Line 2) HC 64 Box 153
(Line 3) Fredonia Az 86022
Contact Person Donn M Dillmore Telephone 520 643 7321 Ext Fax

Application/Initial Fee: Date Rec'd 12/24/98 Check# 221 Amount: $ 3000.
(ALWAYS attach a copy of the CHECK or RECEIPT)

ATC-PR	APP X	WCI-PI	SWA	PPA	HWP
ATC-SA	WPC	WCI-FI	SWE	VOL	HWM
AOC-SA	WPR	WCI-RP	SWP	WQE	HWC
AOC-DR	WRP				

ADEQ Personnel with Billable Hours who worked on this Site:

Period Covered: From: Through:

Name: Ext: Name: Ext:
Name: Ext: Name: Ext:
Project Officer: Ext: Date:
Unit Manager: Ext: Date:
Comments:

PLEASE CIRCLE (O) THE CORRECT BUSINESS TYPE:

I - Native American Owned Entities F - Federal Government S - Satate Government C - County Government
M - Municipal (City) Government D - Districts O - Other

For Cost Recovery Use Only:

	Hours	Activity Code	Sub-Activity Code
Processing Cost Breakdown Attached:			
Final Adminstrative Processing			

Total Hourly Rate$ X Hours: = $

Project Officer Signature Date

Unit Manager

OK to Bill? Yes No Ok to Refund? Yes No

Signature: Ext: Date:

LTF-1060

INTERNATIONAL URANIUM USA CORP 05/97

2555 N HIGHWAY 89A
HC 64 BOX 153 520-643-7321
FREDONIA, AZ 86022

WATER PERMITS
DEC 24 1998
RECEIVED

221

December 4 19 98

31-5/1240
52

PAY TO THE ORDER OF Arizona Department of Environmental Quality $ 3,000.00

The sum of $3,000 and 00 cts DOLLARS

ZIONS BANK
Zions First National Bank
Kanab Office 41 East Center Street
Kanab, Utah 84741

Hermit Mine Clean Closure Review

FOR Fee

Roger B. Smith MP

⑈000221⑈ ⑆124000054⑆ 052 01233 3⑈

©CLARKE AMERICAN BA
GUARDIAN ® SAFETY

IUC INTERNATIONAL URANIUM (USA) CORPORATION

Donn M. Pillmore

H.C. 64
Box 153
2555 No. Highway 89A
Fredonia, AZ 86022

520 643 7321 (phone)
520 643 7328 (fax)

Initial Fee for Clean Closure of
IUC Hermit Mine
Inventory No.: 100299
Site Op No: 50015900

Check was given to Anna Downstairs to be put in safe

IUC INTERNATIONAL URANIUM (USA) CORPORATION

WAT PERMITS 100299
Dec C.D.
NOV 24 1998
RECEIVED

H.C. 64 • Box 153 • 2555 No. Highway 89A • Fredonia, AZ 86022 • 520 643 7321 (phone) • 520 643 7328 (fax)

RECEIVED
DEC 24 1998
WATER PERMITS

December 18, 1998

VIA UPS

Mr. Dennis L. Turner
Aquifer Protection Mining Permits Supervisor
Arizona Department of Environmental Quality
3033 North Central Avenue
Phoenix, Arizona 85012-2809

Re: Hermit Mine Clean Closure

Dear Mr. Turner:

The International Uranium (USA) Corporation (IUSA), Hermit Mine Closure Report is attached hereto, pursuant to a December 2, 1998 telephonic communication with Mr. Craig DeWalt, Aquifer Protection Project Manager, Arizona Department of Environmental Quality (ADEQ), concerning submittals required to finalize closure of the Hermit Mine. Per request by Mr. Craig DeWalt, the closure and post closure requirements listed in the Hermit Mine Groundwater Protection Permit No. G-0035-08 and the closure and post closure requirements listed in the approved U. S. Bureau of Land Management, Plan of Operations, have been addressed in the Hermit Mine Closure Report.

The Hermit Mine Closure Report is submitted to the ADEQ in duplicate to facilitate ADEQ interdepartmental review. Also, the closure review fee pursuant to R18-9-123 (mining categories, surface impoundments) drafted for the full amount of $3,000.00 is attached herewith as Check Number 221.

Should additional information or discussion be required concerning this matter, please contact me or Mr. Roger Smith, General Manager of Mining Operations, at the IUSA office in Fredonia, Arizona, telephone number: (520)643-7321 or FAX number (520)643-7328.

Very truly yours,

Donn M. Pillmore

Donn M. Pillmore
Project Manager

cc: Craig DeWalt, ADEQ
Jayanta Das, ADEQ
D. C. Frydenlund
H. R. Roberts, w/enclosure
R. B. Smith
M. R. Rehmann

IUC
INTERNATIONAL URANIUM (USA) CORPORATION

Independence Plaza, Suite 950 • 1050 Seventeenth Street • Denver, CO 80265 • 303 628 7798 (main) • 303 389 4125 (fax)

WATER PERMITS
JUL 22 1997
RECEIVED

July 16, 1997

Arizona Department of Environmental Quality
3033 North Central Avenue
Phoenix, AZ 85012

Attn: Mr. Tony Bode

Re: Transfer of Arizona APP and GWQPP permits from EFN to IUC

Dear Mr. Bode:

Enclosed are copies of the invoices along with separate checks in payment of all fees due for the transfer of applicable permits from Energy Fuels Nuclear, Inc. to International Uranium (USA) Corporation.

My apologies for the confusion regarding which entity was responsible for payment. If you have any further questions, please contact me at (303) 389-4132.

Sincerely yours,

Vicki L. Hoffsetz
Paralegal / Land Administrator

Enclosures (14)

cc/enc: Michelle Rehmann, Environmental Manager, IUC
Donald L. Peterson, President, Energy Fuels Nuclear, Inc.

1384

INTERNATIONAL URANIUM (USA) CORPORATION
SUITE 950 INDEPENDENCE PLAZA
1050 SEVENTEENTH STREET
DENVER, COLORADO 80265

NORWEST BANK COLORADO, N.A.
DENVER
DENVER, COLORADO 80274
23-7-1020

PAY

ONE HUNDRED THIRTY-NINE DOLLARS AND ZERO CENTS

TO THE ORDER OF

DATE 15-Jul-1997

AMOUNT $139.00

ARIZONA DEPARTMENT OF
ENVIRONMENTAL QUALITY
P.O. BOX 2150
PHOENIX AZ 85001-2150

081004/9-89

Security features included. Details on back.

⑈001384⑈ ⑆102000076⑆ 10 18 16 10 12⑈

INTERNATIONAL URANIUM (USA) CORPORATION

1384

Invoice Number	Inv. Date	Net Invoice
MU97:0171/100299	28-APR-1997	139.00

Check Total 139.00

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Russell F. Rhoades, Director

MU97:0269

July 8, 1997

Vicky Hoffsetz
International Uranium Corporation
1050 17th Street
Suite 950
Denver, CO 80265

Dear Ms. Hoffsetz:

On February 28, 1997, the Water Permits Section - Mining Unit (WPS-MU) of the Arizona Department of Environmental Quality (ADEQ) has received the initial fee to transfer the following permits:

1. Kanab North Mine, GWQPP: G-0007-08, Inventory Number: 100069
2. Hermit Mine, GWQPP: G-0035-08, Inventory Number: 100299
3. Pinenut Mine, GWQPP: G-0036-08, Inventory Number: 100300
4. Canyon Mine, GWQPP: G-0004-03, Inventory Number: 100333
5. Hack Canyon Mine, APP: P-100519,
6. Pigeon Mine, APP: P-101898,
7. Arizona 1 Mine, APP: P-102008,

The permits were transferred on or about April 18, 1997. I have enclosed separate invoices indicating the balance due. Please remit the amount due for each of the facilities. For tracking purposes, the Department requires separate checks. In addition, I have enclosed copies of the paperwork generated for each of the facilities during the transfer process. Please call me at (602) 207-2255 or toll free within the state of Arizona at 1-800-234-5677, ext. 2255, if you have any questions.

Sincerely,

Tony Bode

Tony Bode, Project Officer
Mining Unit
Water Permits Section

TB/tb

Enclosure: Invoice (7), Copies (7 sets)

cc: Lynne Dekarske, WPS

c:\tbl\transfer\MU970269

energy fuels nuclear, inc.

three park central • suite 900
1515 arapahoe street • denver, colorado 80202

303-623-8317
twx 910-931-2561
fax 303-595-0930

May 9, 1997

Tony Bode
Aquifer Protection Project Officer
Arizona Dept. of Environmental Quality
3033 North Central Avenue
Phoenix, AZ 85012

Dear Mr. Bode:

In accordance with the provisions of A.A.C. R18-09-1.03.F, this letter is a notification of a change of the owner and operator for the facilities identified on Exhibit A hereto. Please be advised that the transfer occurred on May 9, 1997. The name and address of the transferor operator and transferee operator are:

Energy Fuels Nuclear, Inc.
1515 Arapahoe Street, Suite 900
Denver, Colorado 80202

Attn: Rich A. Munson
Telephone: (303) 623-8317
Facsimile: (303) 595-0930

International Uranium (USA) Corporation
Independence Plaza, Suite 950
1050 Seventeenth Street
Denver, Colorado 80265

Attn: Michelle R. Rehmann, Environmental Manager
Telephone: (303) 628-7798
Facsimile: (303) 389-4125

Sincerely,

Energy Fuels Nuclear, Inc.

Rich A. Munson
Corporate Counsel

International Uranium (USA) Corporation

Earl E. Hoellen
President

EXHIBIT A
TO NOTICE OF TRANSFER
FROM
ENERGY FUELS NUCLEAR, INC.
TO
INTERNATIONAL URANIUM (USA) CORPORATION

PROPERTY	LOCATION
Canyon Mine - GWPP No. G-0004-03	Section 20 - 29N/3E Coconino County, Arizona North Latitude 35° 53' 00" West Longitude 112° 05' 93"
Hermit Mine - GWPP No. G-0035-08	Section 17 - 38N/4W Mohave County, Arizona North Latitude 36° 41' 25" West Longitude 112° 45' 03"
Kanab North Mine - GWPP No. G-0007-08	Section 17 - 38N/3W Mohave County, Arizona North Latitude 36° 41' 20" West Longitude 112° 38' 36"
Pinenut Mine - GWPP No. G-0036-08	Section 21 - 36N/4W Mohave County, Arizona North Latitude 36° 30' 15" West Longitude 112° 43' 57"

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Russell F. Rhoades, Director

INVOICE

MU97:0171 **Inventory No. 100299**

April 28, 1997

TO:	REMIT TO:
IUC 1050-17th Street, Suite 950. Denver, CO 80265 **Attention: Vicky Hoffsetz** Paralegal for Energy Fuels 1986-1999	Arizona Department of Environmental Quality 3033 North Central Avenue Phoenix, AZ 85012 **Attention: Tony Bode**

Pursuant to R18-14-102.A, the ADEQ shall assess and collect fees for water quality protection services, including any site visits.

R18-14-102. Fee Services

A. ADEQ shall assess and collect fees for water quality protection services, including any site visits.

For Aquifer Protection Permit, Permit Transfer Fees --Energy Fuels Nuclear, Inc., Site Op # 50015900 Charges are calculated as follows:

A.	Initial fee, Permit Transfer @ $400.00 per unit:	$400.00
B.	11 hours @ $49.00 per hour:	$539.00
C.	**BALANCE DUE:**	**$139.00**

THIS INVOICE IS DUE UPON RECEIPT

Please make all checks payable to: **Arizona Department of Environmental Quality**

To ensure proper credit, include a copy of this invoice with your remittance.

cc: Lynne Dekarske, APP Section

c:\tb1\transfer\mu970171.doc

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Russell F. Rhoades, Director

INVOICE

MU97:0171 **Inventory No. 100299**

April 28, 1997

TO:	REMIT TO:
Energy Fuels Nuclear, Inc. Three Park Central, Suite 900 1515 Arapahoe St. Denver, CO 80202 **Attention: Rich Munson**	Arizona Department of Environmental Quality 3033 North Central Avenue Phoenix, AZ 85012 **Attention: Tony Bode**

Pursuant to R18-14-102.A, the ADEQ shall assess and collect fees for water quality protection services, including any site visits.

R18-14-102. Fee Services

A. ADEQ shall assess and collect fees for water quality protection services, including any site visits.

For Aquifer Protection Permit, Permit Transfer Fees --Energy Fuels Nuclear, Inc., Site Op # 50015900 Charges are calculated as follows:

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C.	**BALANCE DUE:**	**$139.00**

THIS INVOICE IS DUE UPON RECEIPT

Please make all checks payable to: **Arizona Department of Environmental Quality**

To ensure proper credit, include a copy of this invoice with your remittance.

cc: Lynne Dekarske, APP Section

c:\tb1\transfer\mu970171.doc

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

INTER-OFFICE MEMORANDUM

MU97:0162 **Inv. No. 100299**

DATE: April 25, 1997

TO: Mike Clark, Director
Business and Finance Section

THRU: DENNIS TURNER DLT
Water Permits Section, Mining Unit

RECEIVED
APR 25 1997
Office of Fiscal Services

FROM: Tony Bode, Project Officer TB
Water Permits Section, Mining Unit

RE: Request for Computer Report of Billable Hours:

Energy Fuels Nuclear - Hermit Mine
Inventory No. 100299
Site/OP Code 50015900

Please provide a computer report for the hours worked on the above referenced project. Please organize the report in columns as follows:

Employee Number	Pay Period End Date	Index	PCA	Activity	Sub Activity	Hours

Thank You for your assistance. If you have any questions, please call me at 207-2255.

c:\tb1\transfer\mu970162.doc

PAY PERIOD END DATE	INDEX	PCA	ACTIVITY	SUB ACTIVITY	GRANT NUMBER	GRANT PHASE	HOURS
19970228	82400	47110	8063	8114			0000600
19970314	82400	47110	8063	8114			0000500

11.0 TONY BODE

COUNT PAY PERIOD END DATE 2

COUNT PAY PERIOD END DATE 2

11.0 11.0

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Russell F. Rhoades, Director

MU97:0155

Inv. No. 100299

April 18, 1997

Rich Munson
Energy Fuels Nuclear, Inc.
Three Park Central, Suite 900
1515 Arapahoe St.
Denver, CO 80202

Dear Mr. Munson:

Our office has received your letter, dated January 31, 1997, requesting a transfer of responsibility for the Groundwater Quality Protection Program (GWQPP) permit for the Hermit Mine. As stated in your letter, Energy Fuels Nuclear, Inc. has transferred all obligations regarding GWQPP permit G-0035-08 to International Uranium (USA) Corporation on or about March 31, 1997.

ADEQ shall be notified within 10 days of a transfer of any GWQPP permit pursuant to Arizona Administrative Code (A.A.C.) R18-9-103.F. The notice shall include the name and address of the transferor and transferee as well as the name and location of the facility

Attached to this letter are copies of the modified pages to the GWQPP. Please attach the enclosed modified pages to the original permit. An initial fee of $400.00 was received by our office on February 28, 1997. A final invoice will be sent to you within 30 days.

Please call me at (602) 207-2255 or toll free within the state of Arizona at 1-800-234-5677, ext. 2255, if you have any questions regarding this permit transfer.

Sincerely,

Tony Bode

Tony Bode, Project Officer
Mining Unit
Water Permits Section

TB/tb

Enclosure

cc: Dennis Turner, Supervisor, WPS-Mining Unit

c:\tb1\transfer\mu970155.doc

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

MU97:0149 **Inventory No: 100299**

TO: Dennis Turner DLT
Supervisor, Water Permits Section, Mining Unit

FROM: Tony Bode
Project Officer, Water Permits Section, Mining Unit

RE: Transfer of Groundwater Quality Protection Permit No. G-0035-08
Hermit Mine

INTRODUCTION

Attached for your signature is a transfer of the above referenced permit. The Hermit Mine is located approximately 21 miles south of the city of Fredonia in Mohave County, Arizona. The permit authorizes the permittee to operate the Hermit Mine, a former underground uranium mine. A temporary cessation of activities is currently in effect. An APP may be required if mining operations resume in the future. No mining operations are permitted at the mine site.

COMMENTS

A letter was received by the ADEQ on January 31, 1997, requesting that responsibility for Groundwater Quality Protection Permit G-0035-08 be transferred to International Uranium (USA) Corporation as part of a change in ownership of the Hermit Mine. Ownership of the mine was transferred from Energy Fuels Nuclear, Inc. to International Uranium (USA) Corporation on or about March 31, 1997.

CONCLUSION

ADEQ shall be notified within 10 days of a transfer of any GWQPP permit pursuant to Arizona Administrative Code (A.A.C.) R18-9-103.F. The notice shall include the name and address of the transferor and transferee as well as the name and location of the facility

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Russell F. Rhoades, Director

MU97:0097

Inventory No. 100069
100299
100300
100333
101898
102008

March 3, 1997

Rich Munson
Corporate Counsel
Energy Fuels Nuclear, Inc.
Three Park Central, Suite 900
1515 Arapahoe Street
Denver, CO 80202

Dear Mr. Munson:

On February 28, 1997, the Water Permits Section - Mining Unit (WPS-MU) of the Arizona Department of Environmental Quality (ADEQ) has received the initial fee to transfer the following permits:

1. Kanab North Mine, GWQPP: G-0007-08, Inventory Number: 100069
2. Hermit Mine, GWQPP: G-0035-08, Inventory Number: 100299
3. Pinenut Mine, GWQPP: G-0036-08, Inventory Number: 100300
4. Canyon Mine, GWQPP: G-0004-03, Inventory Number: 100333
5. Hack Canyon Mine, APP: P-100519,
6. Pigeon Mine, APP: P-101898,
7. Arizona 1 Mine, APP: P-102008,

I have enclosed individual invoices for you to keep for your permanent record. You will be notified of the publication and date for public notice. Please call me at (602) 207-2255 or toll free within the state of Arizona at 1-800-234-5677, ext. 2255, if you have any questions regarding this permit transfer.

Sincerely,

Tony Bode

Tony Bode, Project Officer
Mining Unit
Water Permits Section

TB:ksh

Enclosure: Invoice (7)

cc: Lynne Dekarske, WPS

f:\common\ksh\MU970097

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Russell F. Rhoades, Director

INVOICE

MU97:0091 **Inventory No. 100299**

February 28, 1997

TO:	REMIT TO:
Energy Fuels Nuclear, Inc. Three Park Central, Suite 900 1515 Arapahoe St. Denver, CO 80202	Arizona Department of Environmental Quality 3033 North Central Avenue Phoenix, AZ 85012

Pursuant to R18-14-103, the request for facility transfer must be accompanied with a check for the appropriate amount as specified in the following table:

R18-14-103. Hourly Rates and Initial Fees

C. The initial fees for all ADEQ water quality protection services, set forth in Schedules A or B, shall be paid at the time the request for services is made. When more than 1 initial fee is applicable to a request for multiple water quality protection services, or for application for multiple types of discharging facilities, the initial fee owed shall be the sum of all applicable initial fees, not to exceed the applicable maximum fee. The owner or operator shall remit a separate initial fee for eahc request. If an initial fee exceeds the amaximum fee charged under a fee cap, the owner or operator shall remit the applicalble capped fee.

Categories	*Initial Fee*
Mine Facilities	
Other	*$400*

For Groundwater Quality Protection Permit, Permit Transfer Fees -- Energy Fuels Nuclear, Inc., Hermit Mine, Site Op #: 50015900. Charges are calculated as follows:

A.	1 Permit Transfer @ $400.00 per unit:	$400.00
B.	BALANCE DUE:	$400.00

THIS INVOICE IS DUE UPON RECEIPT

To ensure proper credit, include a copy of this invoice with your remittance. This invoice reflects the initial fee only.

cc: Lynne Dekarske, APP Section

c:\tb1\transfer\mu970091.doc

ENERGY FUELS NUCLEAR, INC.-AGENT
3 PARK CENTRAL, SUITE 900
1515 ARAPAHOE ST.
DENVER, CO 80202
(303) 623-8317

GUARANTY BANK AND TRUST COMPANY
DENVER, CO 80202
23-96-1020

9120

PAY TO THE ORDER OF: FOUR HUNDRED DOLLARS AND ZERO CENTS

DATE: 27-Feb-1997

AMOUNT: $400.00

ARIZONA DEPARTMENT OF
ENVIRONMENTAL QUALITY
P.O. BOX 2150
PHOENIX AZ 85001-2150

Rik Stanley MP

⑈009120⑈ ⑆102000966⑆ 13 21201⑈

081004/9-89

Security features included. Details on back.

ENERGY FUELS NUCLEAR, INC.-AGENT

9120

Invoice Number	Inv. Date	Net Invoice
USAS 50015900	27-FEB-1997	400.00

GWPP Number G-0035-08

HERMIT

Check Total 400.00

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Russell F. Rhoades, Director

MU97:0066

Inventory No. 100069
100299
100300
100333
100519
101898
102008

March 3, 1997

Rich Munson
Corporate Counsel
Energy Fuels Nuclear, Inc.
Three Park Central, Suite 900
1515 Arapahoe Street
Denver, CO 80202

Dear Mr. Munson:

The Arizona Department of Environmental Quality (ADEQ), Water Permits Section - Mining Unit (WPS-MU) has received your letter, dated January 31, 1997, requesting a transfer of responsibility under the Aquifer Protection Permit program (APP) and the Groundwater Quality Protection Permit program (GWQPP) from Energy Fuels Nuclear, Inc. (EFN) to International Uranium [USA] Corporation (IUC) for the following mine sites:

1. Kanab North Mine, GWQPP: G-0007-08, Inventory Number: 100069
2. Hermit Mine, GWQPP: G-0035-08, Inventory Number: 100299
3. Pinenut Mine, GWQPP: G-0036-08, Inventory Number: 100300
4. Canyon Mine, GWQPP: G-0004-03, Inventory Number: 100333
5. Hack Canyon Mine, APP: P-100519,
6. Pigeon Mine, APP: P-101898,
7. Arizona 1 Mine, APP: P-102008,

1. Kanab North Mine

The Kanab North Mine is located at Fredonia, Arizona in Mohave County and is an underground mining operation to define and delineate potential uranium ore deposits and reserves. Pursuant to Arizona Administrative Code (A.A.C.) R18-9-103.F, ADEQ shall be notified within 10 days of a transfer of any GWQPP permit. The notice shall include the name and address of the transferor and transferee as well as the name and location of the facility. Since a GWQPP permit is a water quality protection permit administered by ADEQ, an initial fee of $400.00 per permit must be submitted with the transfer request

pursuant to A.A.C. R18-14-104, Schedule A. In addition, the WPS-MU concurs that the Kanab North facility was required to submit an APP application on or about April 30, 1996. There is no indication in our file that written notification was submitted by the WPS-MU to EFN before the April 30, 1996 call-in date. The Kanab North Mine may have been removed from the call-in list due to cessation of activities during 1990. If the facility was removed from the call-in list for cessation of activities, then no call-in notice would have been issued by ADEQ. However, the call-in date for the APP application would have remained the same. EFN would have been required to submit an APP before April 30, 1996 pursuant to A.A.C. R18-9-104.B. Consequently the WPS-MU agrees to grant EFN an extension to submit the APP application for the Kanab North facility within 120 days after the effective permit transfer date.

2. Hermit Mine

The Hermit Mine is located approximately 21 miles south of Fredonia, Arizona in Mohave County and is an underground uranium mining operation. Pursuant to Arizona Administrative Code (A.A.C.) R18-9-103.F, ADEQ shall be notified within 10 days of a transfer of any GWQPP permit. The notice shall include the name and address of the transferor and transferee as well as the name and location of the facility. Since a GWQPP permit is a water quality protection permit administered by ADEQ, an initial fee of $400.00 per permit must be submitted with the transfer request pursuant to A.A.C. R18-14-104, Schedule A.

3. Pinenut Mine

The Pinenut Mine is located approximately 51 miles south of Fredonia, Arizona in Mohave County and is an underground uranium mining operation. Pursuant to Arizona Administrative Code (A.A.C.) R18-9-103.F, ADEQ shall be notified within 10 days of a transfer of any GWQPP permit. The notice shall include the name and address of the transferor and transferee as well as the name and location of the facility. Since a GWQPP permit is a water quality protection permit administered by ADEQ, an initial fee of $400.00 per permit must be submitted with the transfer request pursuant to A.A.C. R18-14-104, Schedule A.

4. Canyon Mine

The Canyon Mine located 9 miles south of the south rim of the Grand Canyon, Arizona in Coconino County is a fully permitted underground uranium mine, but has not begun any mining operations. ADEQ shall be notified within 10 days of a transfer of any GWQPP permit pursuant to A.A.C. R18-9-103.F. The notice shall include the name and address of the transferor and transferee as well as the name and location of the facility. Since a GWQPP permit is a water quality protection permit administered by ADEQ, an initial fee of $400.00 per permit must be submitted with the transfer request pursuant to A.A.C. R18-14-104, Schedule A.

5. Hack Canyon Mine

The Hack Canyon Mine is located at Fredonia, Arizona in Mohave County and was an underground mining operation which produced 742,000 tons of uranium ore from 1980 through 1987. The mine was issued an APP for clean closure on October 23, 1995. The Director of the ADEQ may transfer APP permit number P-101898 pursuant to A.A.C. R18-9-121.E if it is determined that the proposed transferee complies with the requirements under A.R.S. §§ 49-241 through 251. One of these requirements is a demonstration of financial capability by IUC via one of the mechanisms described in A.A.C. R18-9-108.B.8.c. However, if EFN can demonstrate that the mine has completed the closure tasks described in the closure plan and in Part II, Section B of the APP permit, the Director may waive the financial demonstration. Therefore, please provide the demonstration of clean closure to be reviewed by WPS-MU. An initial fee of $400.00 for each APP permit must be submitted to ADEQ pursuant to A.A.C. R18-14-104, Schedule A.

6. Pigeon Mine

The Pigeon Mine is located at Fredonia, Arizona in Mohave County and was an underground mining operation which produced 439,000 tons of uranium ore from 1984 through 1990. The mine was issued an APP for clean closure on October 23, 1995. The Director of the ADEQ may transfer APP permit number P-101898 pursuant to A.A.C. R18-9-121.E if it is determined that the proposed transferee complies with the requirements under A.R.S. §§ 49-241 through 251. One of these requirements is a demonstration of financial capability by IUC via one of the mechanisms described in A.A.C. R18-9-108.B.8.c. However, if EFN can demonstrate that the mine has completed the closure tasks described in the closure plan and in Part II, Section B of the APP permit, the Director may waive the financial demonstration. Therefore, please provide the demonstration of clean closure to be reviewed by WPS-MU. An initial fee of $400.00 for each APP permit must be submitted to ADEQ pursuant to A.A.C. R18-14-104, Schedule A.

7. Arizona 1 Mine

The Pinenut Mine is located approximately 20 miles south of Fredonia, Arizona in Mohave County and is an underground uranium mining operation. There has been some underground development work at the mine site however, actual mining operations have not commenced. The Director of the ADEQ may transfer APP permit number P-102008 pursuant to A.A.C. R18-9-121.E if it is determined that the proposed transferee complies with the requirements under A.R.S. §§ 49-241 through 251. One of these requirements is a demonstration of financial capability by IUC via one of the mechanisms described in A.A.C. R18-9-108.B.8.c. IUC has provided a demonstration of financial surety that was reviewed by Manuel Sainz, ADEQ's Financial Review Officer on February 19, 1997. An initial fee of $400.00 for each APP permit must be submitted to ADEQ pursuant to A.A.C. R18-14-104, Schedule A.

Fees

Pursuant to A.A.C. R18-14-103.C, the initial fees for all ADEQ water quality protection services must be paid at the time the request for services is made. In addition, when more than one (1) initial fee is applicable to a request for multiple facilities, the initial fee shall be the sum of all applicable initial fees and the owner or operator shall remit a *separate* initial fee for each request (A.A.C. R18-14-103.C).

If you have any questions, please call me at (602) 207-2255 or, toll free within the state of Arizona at 1-800-234-5677, extension 2255.

Sincerely,

Tony Bode

Tony Bode, Project Officer
Mining Unit
Water Permits Section

TB:ksh

Enclosure: R18-14-104, Schedule A

cc: Lynne Dekarske, WPS
Dennis Turner, Supervisor, WPS-Mining Unit

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energy fuels nuclear, inc.

three park central • suite 900
1515 arapahoe street • denver, colorado 80202

Direct: 303 899 7469
303-623-8317
twx 910-931-2561
fax 303-595-0930

AQUIFER PROTECTION
PROGRAM SECTION

FEB 4 1997

RECEIVED

January 31, 1997

Mr. Tony Bode
Aquifer Protection Project Officer
Arizona Dept. of Environmental Quality
3033 North Central Avenue
Phoenix, AZ 85012

Dear Mr. Bode:

This letter follows our meeting on Friday, January 17, 1997, concerning the permits held by Energy Fuels Nuclear, Inc. ("EFN") and the transfer thereof to International Uranium (USA) Corporation ("IUC"). I appreciate the time that you, Mr. Turner, Ms. Bueler and Mr. Sainz took to meet with me and assist EFN in understanding the requirements for these transfers.

As we discussed we have a variety of permits: (i) groundwater protection permits ("GWPP"), (ii) aquifer protection permits ("APP") and (iii) properties initially under notices of disposal but closed under APP closure plans. The attachment to this letter identifies the permits that are held by EFN, the location of each facility and our understanding of the requirements for transfer of each permit.

With regard to the Hack Canyon and Pigeon Mines, as we discussed, these properties are fully reclaimed and are eligible for a "clean closure" under current rules. We will pursue that closure status separately from the transfer. These are the properties that were subject during their operational life to a notice of disposal but, after the reclamation had been completed, the Department required that we submit aquifer protection permit applications to secure approval of our closure procedures.

As to the Arizona I Mine and the APP, as we also discussed, we will be working with Mr. Sainz on the financial capability demonstration and as I understand the process, once we have provided Mr. Sainz with the necessary information that satisfies the requirements, a notice will be issued by the Department which allows a thirty (30) day period for public comment.

In reviewing the permit files, we find that the Kanab North facility had originally been scheduled to submit an APP application on April 30, 1996. For other properties on the APP list for applications, we had received notification from ADEQ approximately 180 days prior to the due date. We do not have a record of receiving such a notice for Kanab North, but if the APP is now overdue, IUC will agree to submit an application within one hundred twenty (120) days of the date of the GWPP transfer for Kanab North.

Here is the necessary information for IUC:

Address:	950 Independence Plaza 1050 17th Street Denver, CO 80202
State of Incorporation:	Delaware
President:	Earl E. Hoellen

We will be providing the financial information directly to Mr. Sainz.

Please feel free to contact me at your convenience if you have any questions or comments on this letter or the transfer process.

Sincerely,

Rich A. Munson
Corporate Counsel

RAM/dpb

VIA FACSIMILE AND REGULAR MAIL
FACSIMILE NUMBER: (602) 207-4674

NOD R9-20-205(A)

PROPERTY	LOCATION	TRANSFER REQUIREMENT
Arizona I Mine - APP 102008	Section 22 - 36N/5W Mohave County, Arizona North Latitude 36° 30' 27" West Longitude 112° 48' 23"	Finding by Director under R18-09-21(E) that Transferee will comply with applicable statutes and regulations; and notification to ADEQ by EFN and IUH of the change in the owner or operator of the Mine under R18-09-03(F);
Canyon Mine - GWPP 100333	Section 20 - 29N/3E Coconino County, Arizona North Latitude 35° 53' 00" West Longitude 112° 05' 93"	Notification to ADEQ by EFN and IUH of the change in the owner or operator of the Mine under R18-09-03(F);
Hack Canyon Mine - NOD/APP Closure 100519	Section 26 - 37N/5W Mohave County, Arizona North Latitude 36° 35' 03" N West Longitude 112° 47' 52" W	Notification to ADEQ by EFN and IUH of the change in the owner or operator of the Mine under R18-09-03(F);
Hermit Mine - GWPP 100299	Section 17 - 38N/4W Mohave County, Arizona North Latitude 36° 41' 25" West Longitude 112° 45' 03"	Notification to ADEQ by EFN and IUH of the change in the owner or operator of the Mine under R18-09-03(F);
Kanab North Mine - GWPP 100069	Section 17 - 38N/3W Mohave County, Arizona North Latitude 36° 41' 20" West Longitude 112° 38' 36"	Notification to ADEQ by EFN and IUH of the change in the owner or operator of the Mine under R18-09-03(F);

Pigeon Mine - NOD/APP Closure 101898	Section 5 - 38N/2W Coconino County, Arizona North Latitude 36° 43' 30" West Longitude 112° 31' 30"	Notification to ADEQ by EFN and IUH of the change in the owner or operator of the Mine under R18-09-03(E);
Pinenut Mine - GWPP 100300	Section 21 - 36N/4W Mohave County, Arizona North Latitude 36° 30' 15" West Longitude 112° 43' 57"	Notification to ADEQ by EFN and IUH of the change in the owner or operator of the Mine under R18-09-03(F);

ATTENDANCE LIST
Meeting between ADEQ & Energy Fuels Nuclear
3033 N. Central Ave, Phoenix, AZ
Room 402
17 January, 1997

Name	Affiliation	Phone
1. Tony Bode	ADEQ, WPAPS-MU	602-207-2255
2. MANNY SAINZ	ADEQ - fin	602-207-4753
3. RICH MURRAY	ENERGY FUELS	3036238317
4. Katherine Buelter	ADEQ, WPAPS-MU	207-4449
5. DENNIS TURNER	MINING UNIT SUPV.	207-4663
6.		
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ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

EVAN MECHAM, GOVERNOR

9/30/87

Mr. Harold Roberts
Energy Fuels Nuclear, Inc.
One Tabor Center
Suite 2500
1200 17th Street
Denver, Colorado 80202

Dear Mr. Roberts:

RE: Hermit Mine
Draft Groundwater Quality Protection Permit No. G-0035-08

Attached for your review and comment is the draft permit for the referenced facility, located approximately 21 miles south of Fredonia, Arizona, in Mohave County. The facility will consist of mine workings to a depth of approximately 1500-feet and a 23-acre surface operations area. The facility will be constructed as a zero discharge facility except for a septic system for disposal of typical domestic wastes. All waters pumped from the underground and all runoff from the surface facility shall be directed to a lined surface impoundment and storm water will be diverted around the facility. All water containment and diversion structures shall be designed, constructed and maintained to control waters from no less than a 100-year, 24-hour precipitation event.

Please return any comments and objections you may have concerning this permit to the Water Permits Unit within thirty (30) days of the date of this letter. If you have any questions concerning this permit, please contact me at 257-6806.

Sincerely,

Carol Russell

Carol Russell
Water Permits Unit

CR:mm
Attachment

cc: U.S. Environmental Protection Agency, Region 9, Mail-Drop W-1-G
Arizona Department of Water Resources, Attn: Clay Cady
Arizona Department of Commerce
Bureau of Land Management
Mohave County Health Department
Western Arizona Council of Governments
Mohave County Planning and Zoning Commission

The Department of Environmental Quality is An Equal Opportunity Affirmative Action Employer

SEP 30 1997
DRAFT FOR REVIEW AND DISCUSSION

STATE OF ARIZONA

GROUNDWATER QUALITY PROTECTION PERMIT

Part I. AUTHORIZATION FOR FACILITY OPERATION SUCH THAT GROUNDWATER QUALITY OF THE STATE OF ARIZONA IS NOT ADVERSELY IMPACTED.

In compliance with the provisions of A.R.S. 36-1851 et seq; A.A.C. Title 9, Chapter 20, Article 2; A.A.C. Title 9, Chapter 21, Article 2; and conditions set forth in this permit:

Facility Name:	Operator:
Hermit Mine	Energy Fuels Nuclear, Inc. One Tabor Center, Suite 2500 1200 Seventeenth Street Denver, Colorado 80202

is authorized to operate the Hermit Mine, an underground uranium mine located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W 1/2 SW 1/4 - Gila and Salt River Base Line and Meridian.

This permit shall become effective on the date of signature and shall be valid for 15 years provided that the facility is operated and maintained in compliance with the specific conditions, general conditions, and information documented or referenced in Parts I, II, III and IV of this Permit and such that groundwater quality standards are not violated (Part V).

Brad L. Doores, Vice President
Legal and Regulatory Affairs
Energy Fuels Nuclear, Inc.

Signed this ____ day of

_____ 19 ___

Gerald Teletzke, Ph.D., Director
Arizona Department of Environmental Health

Signed this ____ day of

_____ 19 ___

SEP 3 0 1987

DRAFT FOR REVIEW AND DISCUSSION

Part II. SPECIFIC CONDITIONS (R9-20-208.C)

A. Disposal/Containment Requirements

1. Facility Water Containment

The facility shall be designed, constructed and maintained such that there will be no migration of wastes or pollutants either directly to groundwater or to the vadose zone.

a. The operator shall be restricted to the disposal of mine water and runoff from a 23-acre uranium mine site to a lined impoundment. All waters pumped from the underground and all runoff from the 23-acre mine operation's area shall be directed to the lined impoundment. The 12.6-acre-foot impoundment shall be lined with synthetic material equivalent to 36 mil Hypalon. The underlying surface shall contain no gravels greater than 1/4 inch. The operator shall maintain a minimum of 3-acre feet (2.4 feet) of freeboard in operating the impoundment. The operator shall maintain a reserve area for the construction of an additional lined impoundment following authorization for an increase in the mine yard disturbance area. The use of enhanced evaporation techniques shall be allowed as an alternative for controlling water level in the lined impoundment.

b. The ore storage pads shall be constructed of crushed and compacted limestone and/or shale not less than 12 inches in thickness. The ore storage pads shall be sloped toward the edges and a runoff collection structure shall be constructed to ensure that all runoff from the ore piles shall be directed to the lined impoundment.

c. The operator shall construct storm water diversion structures, as referenced in "Hydrologic Evaluations for the Proposed Hermit Uranium Mine", Dames & Moore, 1987, to control waters from no less than a 100-year, 24-hour precipitation event. The diversion structures shall be constructed from borrow material from within the operations area and shall be protected with heavy riprap. All construction shall be performed to prevent runoff from the mine operations area.

2. Sewage Disposal

The operator shall construct a septic system with a design capacity of 1,000 gallons per day. The septic system shall be constructed in accordance with plans

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DRAFT FOR REVIEW AND DISCUSSION

approved by the Mohave County Health Department. The septic system shall consist of a septic tank no less than 1,600 gallons and associated leach lines.

3. Unauthorized Materials

a. Materials authorized to be disposed of in the lined impoundment shall not include any materials that cause deterioration of the pond liner as indicated by the manufacturer's specifications for the liner material.

b. Materials authorized to be disposed of in all septic tanks are typical household sewage and shall not include mine water, motor oil, gasoline, paints, varnishes, laboratory wastes, solvents, fertilizers, pesticides or other materials not generally associated with toilet flushing, food preparation, laundry and personal hygiene.

c. Adequate supervision and operation shall be performed to ensure that all users of the facility are aware of and understand the containment/disposal requirements of Part II.A.1.

4. Discharge Source Limits

Total domestic wastewater flow from the facility shall not exceed 1,000 gallons per day.

5. Mining Limit

Total depth of the mine workings shall not exceed 1,500 feet below land surface.

6. Modification

This permit is issued contingent upon the above conditions. The permittee shall give ninety (90) days written advance notice to the Department of any modification to the above facility.

B. Monitoring Requirements, Record Keeping (R9-20-215)

1. Monitoring shall be conducted in three phases:

Phase I - Pre-Mining - Ambient Groundwater Characterization

Phase II - Mining - Evaluation of Possible Impacts

Phase III- Post-Mining - Evaluate the Effectiveness of Closure Activities.

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DRAFT FOR REVIEW AND DISCUSSION

a. Phase I - Pre-Mining

The purpose of Phase I monitoring is to determine baseline, the ambient groundwater characteristics. Ambient groundwater shall be defined as the arithmetic mean plus two standard deviations of the chemical concentrations for each parameter.

(1) The regional aquifer shall be sampled at the monitoring well, Department of Water Resources Well Registry No. as located at and constructed as described in Section 7.c. of the Notice of Disposal. The operator shall monitor this water supply/monitoring well quarterly for the parameters listed in Part II.B.2.b.

(2) Water producing zones shall be monitored in the shaft during shaft sinking. Water quality and quantity shall be taken from every geologic unit which produces water at the time of shaft penetration and quarterly thereafter until mining commences.

b. Phase II - Mining

The purpose of monitoring during the mining phase is to determine what impacts, if any, the operation is having on the groundwater quality.

(1) Discharge Monitoring

On an annual basis the effluent from the septic system shall be sampled and analyzed for those parameters listed in Part II.B.2.b.

(2) Impoundment Monitoring

The operator shall inspect the impoundment for mechanical damage, seam failure and maintenance of freeboard on a daily basis.

(3) Groundwater Monitoring

The operator shall monitor the water supply/monitoring well, Department of Water Resources Well Registry No. , quarterly for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Static water level in the well shall be measured and recorded prior to sample pumping. If the well is

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DRAFT FOR REVIEW AND DISCUSSION

used for production, pumping shall be suspended for 24 hours prior to observing the static water level. The operator shall evacuate at least one bore volume prior to sampling the monitoring well. The amount pumped shall be recorded. The water purged from the well shall be contained in the lined impoundment, stored in impervious containers, or used at the mine site.

(4) Mine Inflow Monitoring

Mine inflows shall be monitored in the shaft and at the mine sump. Within the shaft, water quality and quantity shall be monitored annually from each geologic unit which continues to produce water for the parameters listed in Part II.B.2.b. Water quality analysis shall not be subject to Maximum Groundwater Limits.

Inflows within the mine shall be monitored at the mine sump for quality by quarterly sampling and analysis for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Quantity of mine inflows shall be estimated on a quarterly basis taking into account the consumption of water by underground drilling and dust control, and the return flows from these operations. Any significant inflows shall be depicted on a mine map and submitted to ADEQ as part of the quarterly report.

c. Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

(1) The operator shall monitor the water supply/monitoring well, Division of Water Resources Well Registry No. , quarterly for the parameters in Part II.B.2.b.

(2) The sampling can be discontinued when the sampling location is no longer accessible or when the average concentrations of all parameters are less than or equal to the Maximum Groundwater Limit plus two standard deviations. The arithmetic average shall be calculated based on a five-point running

SEP 3 0 1997

DRAFT FOR REVIEW AND DISCUSSION

average, the latest concentration and the four previous concentrations after closure.

Any individual concentrations that exceed the pre-mining mean concentration plus four standard deviations shall be rejected as anomalous and not used for calculation of the five-point running averages unless two samples in a row exceed the mean concentration.

2. Constituents for Analyses

Two categories of constituents for analysis shall be used while monitoring - indicator parameters with Alert Levels and comprehensive list of parameters with Maximum Groundwater Limits:

a. Indicator Parameters

If laboratory chemical analyses for a water sample would detect concentrations of gross alpha, gross beta, and/or any of the selected trace elements in excess of the alert levels, the source for the water sample would be resampled and analyzed for the comprehensive list of parameters:

SEP 3 0 1987
DRAFT FOR REVIEW AND DISCUSSION

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	0.025	1	206.2
Barium	0.5	2	208.1
Cadmium	0.005	1	213.2
Copper	0.5	2	220.1
Iron	0.15	2	236.1
Lead	0.025	1	239.2
Manganese	Reserved*	2	242.1
Mercury	0.001	1	245.1
Nitrate (as N)	5.0	3	---
Selenium	0.005	1	270.2
Silver	0.025	2	272.1
Zinc	5.0	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	5.0	4,13	703
Gross Beta	5.0	4,13	703

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved*	4	403
Arsenic	0.05	1	206.2
Barium	1.0	2	208.1
Bicarbonate	Reserved*	3	305.1
Cadmium	0.010	1	213.2
Calcium	Reserved*	2	215.1
Carbonate	Reserved*	4	403
Chloride	Reserved*	3	325.3
Chromium (total)	0.05	1	218.2
Copper	1.0	2	220.1

(1) Standard references are listed on Attachment I to this Permit.

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(Cont'd.)

PARAMETER	MAXIMUM GROUND-WATER LIMITS	REF I.D.(1)	METHOD OF ANALYSIS
	(milligrams per liter)		
Fluoride	2.4	3	340.2
Iron	0.3	2	236.1
Lead	0.05	1	239.2
Magnesium	Reserved*	2	243.1
Manganese	Reserved*	2	243.1
Mercury	0.002	1	245.1
Nitrate (as N)	10.0	3	---
Phosphate	Reserved*	4	424
Potassium	Reserved*	2	258.1
Selenium	0.01	1	270.2
Silver	0.05	2	272.1
Silica	Reserved*	-	---
Sodium	Reserved*	2	273.1
Sulfate	Reserved*	3	375.3
Total Dissolved Solids	Reserved*	3	160.3
Zinc	Reserved*	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved*	3	120.1
	(picocuries per liter)		
Gross Alpha	15	4,13	703
Gross Beta	50	4,13	703
Total Uranium	Reserved*	9,10	---
Thorium 230	Reserved*	9,10	---
Radium 226	Reserved*	4,7	705,706

(1)Standard references are listed on Attachment I to this Permit.

* Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

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(1) If a primary or secondary drinking water standard or Maximum Groundwater Limit has been established for a parameter by Arizona State regulatory agencies, and if the arithmetic mean plus two standard deviations of concentrations of the parameter in groundwater samples obtained during the pre-mining period does not exceed the drinking water standard, the Maximum Groundwater Limit shall be the drinking water standard.

If the arithmetic mean plus two standard deviations of concentrations of the parameter exceeds an established primary or secondary drinking water standard, the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of concentration of the parameter in groundwater samples.

(2) If a primary or secondary drinking water standard has not been established by the regulatory agencies for a parameter and the parameter is detected in groundwater samples during the pre-mining period, or if the arithmetic mean plus two standard deviations of concentrations in groundwater samples obtained during the pre-mining period exceeds the established drinking water standard, then the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of the pre-mining concentrations.

(3) If a parameter is not detected during the pre-mining monitoring period, and a primary or secondary drinking water standard has not been established for the parameter, the Maximum Groundwater Limit shall be twice the detection limit for the EPA laboratory method used.

3. Monitoring Forms

All monitoring results shall be recorded and reported on the Self-Monitoring Form supplied by ADEQ. This form should be given to the laboratory performing the analysis.

4. Reporting

The permittee shall submit a report summarizing progress of the mine development and monitoring results on an annual basis. The report shall contain a current site plan, a map of the underground mine workings including elevations, and shall indicate the locations of all monitoring sites required by this permit. All analytical monitoring results for the previous quarter shall be postmarked no later than

the 28th day of the second month following the completed reporting period as indicated below:

Self-Monitoring Report Forms for	are due by
1st Quarter (Jan, Feb, Mar)	May 28
2nd Quarter (Apr, May, Jun)	Aug 28
3rd Quarter (Jul, Aug, Sep)	Nov 28
4th Quarter (Oct, Nov, Dec)	Feb 28

All laboratory reports shall be submitted to the following location:

Arizona Department of Environmental Quality
OWWQM - Water Pollution/UST Compliance Unit
2005 North Central Avenue
Phoenix, Arizona 85004

C. Contingency Requirements

1. Should any of the monitoring results required by this permit exceed the alert level specified for a particular parameter, the permittee shall immediately notify the Department of the apparent exceedance and resample to determine the validity of the sample result.

2. In the event that a confirmed exceedance of the Maximum Groundwater Limit specified in Part II.B.2.b. occurs at the monitoring well, the operator shall submit a report within 60 days which assesses the impacts from the exceedance and the mining operation.

3. In the event that the minimum freeboard requirement specified in Part II.A.1.a. is violated, the permittee shall construct an additional impoundment equivalent in construction to the lined impoundment required by Part II.A.1.a.

4. In the event that any portion of the containment system or the septic system fails, resulting in the violation of permit conditions, the owner/operator shall notify the Department's Water Pollution/UST Compliance Unit and the Mohave County Health Department immediately to determine the appropriate action to mitigate the effects of the violation.

D. Closure/Post Closure

1. The Department shall be notified in writing at least one hundred and eighty (180) days prior to closure or abandonment of the facility. The operator shall submit and have approved an updated Post-closure Plan prior to this time.

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2. Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of clay, shale or bentonite plugs in both the main shaft, the air shaft and the monitoring well.

3. Following the expiration date of this permit, the permittee shall continue monitoring listed in Part II.B.1.c. on a quarterly basis. In the event that a Maximum Groundwater Limit as described in Part II.B.2.b. is confirmed to be exceeded, the permittee shall immediately notify the Department and, within 30 days of such a violation, submit a plan to mitigate the effects of the violation.

4. In the event that the septic system is abandoned for any reason, any remaining septage shall be disposed of off-site at a location approved to accept such wastes.

E. Compliance Schedule (R-20-219)

1. Within 60 days of the completion of the main shaft sinking, the operator shall submit an analysis showing that the collection sumps are impermeable and the sumps do not leak or the operator shall provide a plan for containment.

2. The operator shall notify the Water Pollution/UST Compliance Unit no less than 7 days prior to the installation of the liner specified in Part II.A.1.

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Part III. REFERENCES: PERTINENT INFORMATION

A. References

The terms and conditions set forth in this permit have been developed based upon the information contained in the following:

1. Groundwater Field Inspection Form(s) dated _____

2. Notice of Disposal dated June 14, 1987

3. Groundwater Impact Review dated August 4, 1987

4. Plan Review File Number _____

5. Permit Application dated _____

6. Groundwater Impact Review dated _____

7. Amendments to 2 and 4 dated _____

8. Public Notice dated September 14, 1987

9. Public Hearing comments, correspondence letters, and any additional supplemental information contained in the facility permit file.

10. Other _____

B. Facility Information

1. Facility Contact Person _____

2. Address _____

3. Emergency Telephone Number: Business ( )

Home ( )

The Department shall be notified within 30 days of a change in the facility contact person.

4. Landowner of Facility Site B. L. M.

C. Definitions

1. "Abandoned" means permanent cessation of facility operation, as determined by the facility owner. Facilities which are temporarily shut down are not considered abandoned within the context of these regulations.

2. "Activity" means any human activity including institutional, commercial, manufacturing, extraction, agricultural, or residential land use which may involve disposal of wastes or pollutants which may result in pollution of groundwaters of the State.

3. "Adverse impact upon groundwater quality" means any measurable change to the physical, chemical or biological character of groundwater caused by addition of pollutants or wastes.

4. "Approved" or "approval" means approved in writing by the Director.

5. "Aquifer" means a geologic unit that contains saturated permeable material to yield usable (drinking water, agriculture, industry, etc.) quantities of water to a well or spring.

6. "Composite sample" means a combination of 4 individual portions obtained at equal time intervals for 1 hour. The volume of each individual portion shall be directly proportional to the discharge flow rate at the time of sampling. The sampling period shall coincide with the period of maximum discharge flow.

7. "Department" means the Arizona Department of Environmental Quality (ADEQ).

8. "Director" means the Director of the Arizona Department of Environmental Quality or his duly authorized representative.

9. "Discharge" means the addition, spilling, leaking, pumping, pouring, emitting or dumping of any pollutant into waters of the State from any point source.

10. "Discharge Impact Area" means the potential area extent of waste or pollutant migration, as projected on the land surface, as a result of a discharge or disposal from a facility.

11. "Discrete sample" means any individual sample collected in less than 15 minutes.

12. "Disposal" means the discharge, deposit, well injection, dumping, spilling, leaking, or placing of any wastes or pollutants into or on any land or water such that groundwater is or may be affected. For the purposes of this Article, irrigation with effluent from a wastewater treatment facility is disposal if the application rate exceeds that amount necessary to satisfy the consumptive use and leaching requirements of the crop or landscaping being irrigated.

13. "Disposal system" means a system for disposing of wastes either by surface or underground methods and includes sewerage systems, treatment works, disposal wells and other systems.

14. "Facility" means any system or activity in which or by which disposal occurs or has occurred on either a continuous or intermittent basis.

15. "Flow rate" means the volume per unit time given to the flow of fluids.

16. "Geologic unit" means a geologic formation, group of formations, or part of a formation.

17. "Groundwater" means water under the surface of the earth regardless of the geologic structure in which it is standing or moving. Groundwater does not include water flowing in underground streams with ascertainable beds and banks.

18. "Groundwater Quality Standards" means the standards in A.A.C. R9-21-403.

19. "Hazardous waste" means a waste as defined by the Federal Resource Conservation and Recovery Act (P.L. 94-580).

20. "Hydraulic conductivity" means a measure of the capability of a geologic unit to transmit a fluid.

21. "Individual disposal system" means a device or system for the treatment or disposal of sewage from a single housing unit or equivalent.

22. "Maximum Disposal Limit (MDL)" means the maximum permissible level for a contaminant in an effluent stream.

23. "Maximum Groundwater Limit (MGL)" means the maximum permissible level for a contaminant in water.

24. "Modification" means a change in the location, volume, constituent(s) or constituent concentration(s) of a disposal which is described in the permit issued pursuant to R9-20-208.

25. "Operator" means any person who makes management decisions regarding facility operations.

26. "Owner" means any person holding legal or equitable title in any real property subject to these regulations.

27. "Permit" means a rule, certificate, letter, or any other document issued by the Director authorizing and conditioning the discharge of any pollutant to groundwater from any point source or disposal of wastes from any disposal system identified in A.R.S. Sec. 36-136.G.8.

28. "Pollute" means to cause pollution.

29. "Regulations" means A.A.C. Title 9, Chapter 20, Article 2, requirements for facilities affecting groundwater quality.

30. "Schedule of compliance" or "compliance schedule" means a written document issued by the Director which identifies requirements and times for compliance with either or both the water quality standards in A.A.C. Title 9, Chapter 21 or the permit regulations in A.A.C. Title 9, Chapter 20.

31. "Sewage" means wastes from toilets, baths, sinks, lavatories, laundries and other plumbing fixtures in residences, and wastes from institutions, commercial buildings, mobile homes and other places of human habitation, employment or recreation which are similar in content to residential wastes.

32. "Site" means the area where any facility is physically located or an activity is conducted, including adjacent land used in connection with the facility.

33. "Treatment works" means any plant or other works used for the purpose of treating, stabilizing, or holding wastes.

34. "Vadose zone" means the zone between the land surface and the principle zone of saturation.

Part IV. GENERAL CONDITIONS: RESPONSIBILITIES

A. Permit Duration (R9-20-210)

1. Permits shall be valid for the expected operational life of the facility under the ownership as set forth in the permit unless otherwise limited by Federal or State statute or transferred pursuant to R9-20-221.C.

2. A permit may be modified or terminated pursuant to R9-20-221.

3. The owner or operator of the facility may request that a permit be issued for a duration that is less than the full allowable term.

B. Permit Rights (R9-20-214)

1. A permit does not convey any property or water right of any sort, or any exclusive privilege.

2. A permit does not authorize any injury to persons or property or invasion of other private rights, or any infringement of Federal, State, or local laws or regulations.

C. Monitoring Requirements; Record Keeping (R9-20-215)

1. The permittee shall implement and maintain an approved monitoring system if required as a condition of a permit.

a. The permittee shall install, use and maintain all monitoring equipment in acceptable condition or provide alternate methods approved by the Department.

b. The permittee is required to conduct monitoring of a type and frequency sufficient to yield data which are representative of the monitored activity.

2. The permittee shall retain records or have access to all monitoring information, for a period of at least three (3) years from the date of the sample, or measurement. This period may be extended by written request of the Department at any time. Copies of records shall be furnished to the Department upon written request.

a. Records of monitoring information shall include but are not limited to the following:

(1) The date, time, exact place, and name of individual(s) who performed the sampling or measuring;

(2) the date(s) of, and name(s) of the individual(s) who performed the analyses; and

(3) the analytical techniques or methods used to perform the analyses.

b. Monitoring results shall be reported at intervals specified in the permit.

c. Calculations which require the averaging of measurements shall utilize an arithmetic mean unless it can be demonstrated by the permittee that another method would more accurately describe or be representative of the monitored activity.

3. Information submitted as a result of any well boring shall include a complete driller's log and drawings showing details of the well's construction. If information must be submitted more than once for the same well, then subsequent submittals shall note that the driller's log and construction drawings have already been submitted and the date of the initial submittal shall be documented.

D. Reporting Requirements (R9-20-216)

1. The permittee shall give ninety (90) days written advance notice to the Department of any modification to the facility which is not described in the approved Notice of Disposal or permit application.

2. The permittee shall notify the Department within seventy two (72) hours of becoming aware of any permit violation. The Department may require the permittee to submit a written report within thirty (30) days documenting the following:

a. A description of the noncompliance and its cause;

b. the period of noncompliance, including exact date(s) and time(s), and the anticipated time period during which the noncompliance is expected to continue if it has not been completely corrected;

c. action taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance: If applicable, such action shall be in accordance with an approved contingency plan;

d. monitoring or other information which indicates that any waste or pollutant may cause an endangerment to an aquifer; and

e. noncompliance with a permit condition, or malfunction of the disposal system which may cause fluid migration into or between aquifers.

3. The Department shall be notified in writing at least one hundred eighty (180) days prior to abandonment of the facility.

a. The permittee may be required to submit a detailed post-closure plan to the Department for approval which shall describe what the physical condition of the facility will be on the date operations are terminated.

b. The Department may require the post-closure plan to include any or all of the following:

(1) A description of monitoring procedures to be implemented by the permittee including monitoring frequency, type, and location which will be implemented to ensure post-closure activities will not violate groundwater quality standards;

(2) a description of procedures for maintaining existing groundwater quality protection systems;

(3) a schedule and description of physical inspections to be conducted at the facility following abandonment;

(4) a description of future land or water uses or both which may be precluded as a result of facility abandonment; and

(5) identification of responsibilities for post-closure cleanup or remedial action in the event of pollution of waters of the State.

E. Site Examination (R9-20-217)

1. The Department may routinely inspect the facility or an activity used for the generation, storage, treatment, collection, or disposal of any waste or pollutant, and where records are kept, for the purpose of determining compliance with these regulations or water quality standards, or verifying information submitted in a Notice of Disposal, or permit application, or documented in a permit including any permit conditions.

2. The Department may:

a. Obtain samples of wastes or pollutants;

b. analyze or cause to be analyzed any samples either on site or at another location;

c. take photographs of waste and equipment processes and conditions at the site; or

d. inspect and copy any pertinent records, reports, information, and test results.

3. Any pertinent information required by the permit to be maintained by the permittee shall be available for on-site inspection during normal business hours. Split samples and copies of photographs will be provided to the facility owner or operator if the owner or operator requests them at the time the sample(s) is obtained or the photograph(s) is taken as the case may be.

4. Inspections shall be conducted pursuant to the appropriate provisions of the Arizona Revised Statutes and policies established by the Department.

F. Proper Operation and Maintenance (R9-20-218)

The permittee shall at all times maintain in good working order and operate properly all treatment works installed or used for water pollution control and abatement to achieve compliance with the terms and conditions of the permit and water quality standards. If required by Article 5 of A.A.C. Title 9, Chapter 20, the permittee shall retain the services of an operator certified by the Department at the level appropriate to the permitted facility.

G. Permit Conditions (R9-20-220)

1. Duty to Mitigate

The permittee shall take all steps to minimize and correct any adverse impact on groundwater quality as defined in A.A.C. Title 9, Chapters 20 and 21 resulting from noncompliance with the permit.

2. Duty to Reapply

If a permittee has not been issued a permit for the life of the facility, a renewal application in the form of an amended Notice of Disposal or permit application shall be submitted to the Department no less than one hundred eighty (180) days prior to expiration of the existing permit.

3. Duty to Comply

The permittee shall comply with all terms and conditions

of the permit, and take such action as is necessary to ensure compliance.

H. Permit Actions (R9-20-221)

1. This permit may be modified, transferred, renewed, or revoked for cause. The filing of a request by the permittee for a permit action does not stay any existing permit condition.

2. Permit Modification

a. Request for modification of a permit may be made by the permittee, the Department, or any affected person and shall identify the specific item(s) to be considered for modification.

b. Public requests for modification of a permit shall be in writing to the Department and shall contain technical facts or reasons which justify the requested changes. The Department upon receipt of the request will notify the permittee, and evaluate and determine whether any request for modification shall be granted.

c. The permittee may be required to submit additional information, including an updated Notice of Disposal or permit application.

d. Only those items considered for modification may be changed, and all other conditions of the existing permit will remain in effect.

e. The following circumstances and occurrences shall require modification of a permit:

(1) Modification to the facility, which justify application of permit conditions that are different from or absent in the existing permit;

(2) other information that was not available when the existing permit was issued, and which justifies application of different permit conditions;

(3) changes in the regulations or standards upon which the permit was based which have been made after the permit was issued;

(4) good cause exists for changes in a compliance schedule because of conditions over which the permittee has little or no control, and a change to the permit by

modification is a reasonable remedy;

(5) reason(s) exists for revocation of the permit, and the Department determines that modification is an appropriate method for change; and

(6) amendment to an approved abandonment plan or contingency plan or any other portion of an approved Notice of Disposal or permit application.

f. The suitability of the location of the facility will not be reconsidered during the process of changing the permit unless new information or change to regulations indicate that a violation of adopted groundwater quality standards exist and no other action is possible to mitigate the violation and comply with groundwater quality standards.

g. The Department will publish a notice of intent pursuant to R9-20-223 to modify a permit before any final action is taken.

h. With the concurrence of the permittee, the Department may make minor modifications to a permit for any of the following reasons:

(1) To correct typographical errors;

(2) to require more or less frequent monitoring or reporting by the permittee;

(3) to change an interim compliance date in a schedule of compliance, provided the new date is not more than sixty (60) days after the date specified in the existing permit, and does not interfere with attainment of the final compliance date requirement;

(4) to change quantities or types of fluids discharged which are within the capacity of the facility as permitted, and in the judgment of the Department would not interfere with the operation of the facility or its ability to meet conditions prescribed in the permit, and would not change its classification, if the facility is an injection well; or

(5) to change construction requirements approved by the Department, provided that any such alteration shall comply with the requirements of these regulations.

3. Permit Transfer

a. This permit is transferrable to any person after thirty (30) days advance written notice to the Department. The Department may require modification of the permit to change the name of the permittee and incorporate any requirements which may be necessary to ensure compliance with State statutes and regulations.

b. The permittee shall notify by registered letter a new owner or operator of a permitted facility of the existence of the permit thirty (30) days prior to transfer of responsibility. The notice shall include a copy of the permit. A copy of the letter shall be transmitted to the Department.

c. The new owner or operator shall be responsible for compliance with the permit upon transfer of ownership or operation without regard to whether said owner or operator has in fact received the notice required by R9-20-221.C.2.

d. Permit transfer does not absolve the previous permittee of any liability existing at or before the time the permit was transferred.

4. Permit Revocation

a. Request for revocation of a permit may be made by the permittee, Department, or any affected person.

b. Public requests for permit revocation shall be in writing to the Department and shall contain technical facts or reasons which justify the requested action. The Department upon receipt of the request will notify the permittee and evaluate the request and determine whether any request for revocation should be granted.

c. Revocation of a permit is initiated when the Department issues a notice of intent to revoke a permit pursuant to R9-20-223 to the permittee and may be initiated for the following reasons:

(1) Noncompliance by the permittee with any permit condition;

(2) deliberate failure by the permittee to fully disclose all relevant facts when applying for a permit;

(3) intentional or deliberate misrepresentation of any relevant fact at any time by the permittee; or

(4) if it is determined by ADEQ that the permitted activity is causing a violation of groundwater quality standards and such violation can only be regulated to acceptable levels by revoking the permit.

d. If disposal to an aquifer causes a clear, present, and immediate danger to the health or welfare of persons, the Department may immediately suspend a permit. Within fourteen (14) days of the suspension, the Department shall issue a notice of intent to revoke the permit. The permit shall be considered revoked thirty (30) days after the notice of intent is issued by the Department unless and until a hearing is requested by the permittee pursuant to R9-20-222.

I. Confidentiality of Information (R9-20-224)

1. Any information submitted to or obtained by the Department pursuant to these regulations may be claimed as confidential by the facility owner or operator. Any such claim shall be asserted at the time the information is submitted or obtained. If no claim is made at that time, the Department may make the information available to the public without further notice.

2. Claims of confidentiality for the following information shall be denied:

a. The name and address of any permit applicant or permittee; or

b. information which deals with the present or future existence, absence, or level of waste(s) or pollutant(s) in water.

3. Criteria for determining confidentiality are:

a. A confidentiality claim has been made at the time the information was submitted or obtained;

b. the facility owner or operator has shown that reasonable measures have been taken to protect the confidentiality of the information, and intends to continue to take such measures;

c. the information is not, and has not been, reasonably obtainable without the facility owner or operator's consent;

d. no statute specifically requires disclosure of the information; and

e. the facility owner or operator has shown that disclosure of the information is likely to cause harm to it's competitive position; or, the information is voluntarily submitted and disclosure would be likely to impair the State's ability to obtain necessary information in the future.

J. Enforcement and Penalties (R9-20-225)

See 2/1/1999 memo/file to Craig DeWalt (ADEQ) from Donn Pillmore (Energy Fuels/ International Uranium) Some reported concentrations of U in groundwater monitoring were lower than the detection limit for the method used.

Any person who constructs, operates, or maintains a facility, disposal system, or introduces wastes or pollutants to waters of the State contrary to the provisions of this permit, falsifies data or information submitted to the Department as a result of the requirements of this permit, or otherwise violates the provisions of this permit, shall be subject to enforcement and penalties pursuant but not limited to A.R.S. 36-1864.01.

PART V. GROUNDWATER QUALITY STANDARDS

A. General Standards Applicable to all Groundwaters (R9-21-403)

1. Discharges of any pollutants and disposal of any wastes shall not impair the uses which have been made, are being made, or will be made of groundwater for every purpose.

2. Discharges of any pollutants and disposal of any wastes to groundwaters of the State shall not cause a public health hazard.

3. Disposal of any hazardous waste, radioactive waste or other waste shall not cause toxic substances to be present in groundwaters of the State in concentrations which are or may be hazardous to public health or which interfere with present and future uses of the groundwater.

4. Discharges of any pollutants and disposal of any wastes to groundwaters of the State shall not directly or indirectly cause violation of surface water quality standards established pursuant to Article 2 of this chapter.

ATTACHMENT I

Permit No. G-0035-08

REFERENCE

1. Flameless A.A., Methods for Chemical Analysis of Water and Wastes, 1980. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268 March 1983.

2. Flame A.A., Methods for Chemical Analysis of Water and Wastes, 1980. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268, March 1983.

3. Methods for Chemical Analysis of Water and Wastes, 1980. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268, March 1983.

4. Standard Methods for the Examination of Water and Wastewater, 16th ed., American Public Health Assoc., 1975.

5. Methods for Determination of Radioactive Substances in Water and Fluvial Sediments, Techniques of Water Resources Investigations of the U.S. Geological Survey, Chapter A5, 1977.

6. Quantitative Radiochemical Method for Determination of Major Sources of Natural Radioactivity in Ores and Minerals, p. 1307, ACS, Aug. 1954; and p. 1398, ACS, Oct. 1957, N.C. Rosholt, Jr.

7. The Determination of Radium-226 in Uranium Ores and Mill Products by Alpha Energy Spectrometry, Canmet Report 76-11, Canadian Centre for Mineral and Energy Technology.

8. Analytical Method for the Determination of Polonium 210, Thorium 230 in Uranium Ore, Concentrates, and Plant Liquors, PG report 356(s), United Kingdom Atomic Energy Authority.

9. Microquantities of Uranium in Water by Flourimetry, Annual Book of ASTM Standards, 1973, (D2907) 23.

10. Manual of Analytical Methods for the Uranium Concentrating Plant, Mines Branch Monograph 866, Dept. of Mines and Technical Surveys, Ottawa, Canada, (1959).

11. Handbook of Analytical Procedures, J.M. Latimer, et al, ROM-3008, USAEC, Grand Junction Office, Analytical Laboratory, February, 1970.

12. Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032, 1980. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268.

13. Interim Radiochemical Methods for Drinking Water, EPA-600/4-75-008, March 1976. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268.

GROUNDWATER QUALI D TION
PERMIT NO. G-0035 3

Patty:
Please re-type
pages w/ changes -
make changes in bold type.
Thx Ed

4 pages

STATE OF ARIZONA

GROUNDWATER QUALITY PROTECTION PERMIT

Part I. AUTHORIZATION FOR FACILITY OPERATION SUCH THAT GROUNDWATER QUALITY OF THE STATE OF ARIZONA IS NOT ADVERSELY IMPACTED.

In compliance with the provisions of A.R.S. 36-1851 et seq; A.A.C. Title 9, Chapter 20, Article 2; A.A.C. Title 9, Chapter 21, Article 2; and conditions set forth in this permit:

Facility Name:	Operator:
Hermit Mine	Energy Fuels Nuclear, Inc. One Tabor Center, Suite 2500 1200 Seventeenth Street Denver, Colorado 80202

is authorized to operate the Hermit Mine, an underground uranium mine located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W 1/2 SW 1/4 - Gila and Salt River Base Line and Meridian.

This permit shall become effective on the date of signature and shall be valid for 15 years provided that the facility is operated and maintained in compliance with the specific conditions, general conditions, and information documented or referenced in Parts I, II, III and IV of this Permit and such that groundwater quality standards are not violated (Part V).

Brad L. Doores

Brad L. Doores, Vice President
Legal and Regulatory Affairs
Energy Fuels Nuclear, Inc.

Signed this 8th day of January 19 88

Ronald L. Miller

Ronald L. Miller, Ph.D., Assistant Director
Arizona Department of Environmental Quality

Signed this 29th day of December 19 87

Part II. SPECIFIC CONDITIONS (R9-20-208.C)

A. Disposal/Containment Requirements

1. Facility Water Containment

The facility shall be designed, constructed and maintained such that there will be no migration of wastes or pollutants either directly to groundwater or to the vadose zone.

a. The operator shall be restricted to the disposal of mine water and runoff from a 23-acre uranium mine site to a lined impoundment. All waters pumped from the underground and all runoff from the 23-acre mine operation's area shall be directed to the lined impoundment. The 12.6-acre-foot impoundment shall be lined with synthetic material equivalent to 36 mil Hypalon. The underlying surface shall contain no gravels greater than 1/4 inch. The operator shall maintain a minimum of 3-acre feet (2.4 feet) of freeboard in operating the impoundment. The operator shall maintain a reserve area for the construction of an additional lined impoundment following authorization for an increase in the mine yard disturbance area. The use of enhanced evaporation techniques shall be allowed as an alternative for controlling water level in the lined impoundment.

b. The ore storage pads shall be constructed of crushed and compacted limestone and/or shale not less than 12 inches in thickness. The ore storage pads shall be sloped toward the edges and a runoff collection structure shall be constructed to ensure that all runoff from the ore piles shall be directed to the lined impoundment.

c. The operator shall construct storm water diversion structures, as referenced in "Hydrologic Evaluations for the Proposed Hermit Uranium Mine", Dames & Moore, 1987, to control waters from no less than a 100-year, 24-hour precipitation event. The diversion structures shall be constructed from borrow material from within the operations area and shall be protected with heavy riprap. All construction shall be performed to prevent runoff from the mine operations area.

2. Sewage Disposal

The permittee is restricted to dispose the sewage generated from the travel trailers, office and host buildings into a septic tank and associated leach

lines. The septic tank, constructed in accordance with plans approved by the Mohave County Health Department, shall have a capacity of no less than 1,600 gallons and receive a maximum of 1,000 gallons per day of sewage.

3. Unauthorized Materials

   a. Materials authorized to be disposed of in the lined impoundment shall not include any materials that0 cause deterioration of the pond liner as indicated by the manufacturer's specifications for the liner material.

   b. Materials authorized to be disposed of in all septic tanks are typical household sewage and shall not include mine water, motor oil, gasoline, paints, varnishes, laboratory wastes, solvents, fertilizers, pesticides or other materials not generally associated with toilet flushing, food preparation, laundry and personal hygiene.

   c. Adequate supervision and operation shall be performed to ensure that all users of the facility are aware of and understand the containment/disposal requirements of Part II.A.1.

4. Discharge Source Limits

   Total domestic wastewater flow from the facility shall not exceed 1,000 gallons per day.

5. Mining Limit

   Total depth of the mine workings shall not exceed 1,500 feet below land surface.

6. Modification

   This permit is issued contingent upon the above conditions. The permittee shall give ninety (90) days written advance notice to the Department of any modification to the above facility.

7. Other Laws and Rules

   The operator must maintain compliance with all other State of Arizona laws and rules. The issuance of this permit does not waive any federal, state, county, or local government rules, regulations, or permits for which this facility may have to comply.

B. Monitoring Requirements, Record Keeping (R9-20-215)

1. Monitoring shall be conducted in three phases:

Phase I - Pre-Mining - Ambient Groundwater Characterization

Phase II - Mining - Evaluation of Possible Impacts

Phase III- Post-Mining - Evaluate the Effectiveness of Closure Activities.

a. Phase I - Pre-Mining

The purpose of Phase I monitoring is to determine baseline, the ambient groundwater characteristics. Ambient groundwater shall be defined as the arithmetic mean plus two standard deviations of the chemical concentrations for each parameter.

Major cations and anions in monitoring samples suggest one of the perched wells were used for sampling. Well 55-518877 was a R/M water well
Pre-mining groundwater samples were collected from a livestock well and boreholes

(1) The regional aquifer shall be sampled at the monitoring well, Department of Water Resources Well Registry No. 55-518877 as located at and constructed as described in Section 3.c. of the Notice of Disposal. The operator shall monitor this water supply/monitoring well quarterly for the parameters listed in Part II.B.2.b.

(2) Water producing zones shall be monitored in the shaft during shaft sinking. Water quality and quantity shall be taken from every geologic unit which produces water at the time of shaft penetration and quarterly thereafter until mining commences.

(3) Sixty (60) days after obtaining all of the Phase I water quality data as described above, the permittee shall submit a report to the Department's Water Permits Unit which summarizes the water quality data and establishes the Maximum Groundwater Limits for each sampling parameter. The Comprehensive List of Parameters listed in Part II.B.2.b. shall be utilized for this sampling report.

b. Phase II - Mining

The purpose of monitoring during the mining phase is to determine what impacts, if any, the operation is having on the groundwater quality.

(1) Discharge Monitoring

On an annual basis the effluent from the septic system shall be sampled and analyzed for those parameters listed in Part II.B.2.b. The sampling point shall be located after the effluent flows from the septic tank and before disposal to the leach trenches.

(2) Impoundment Monitoring

The operator shall inspect the impoundment for mechanical damage, seam failure and maintenance of freeboard on a daily basis.

(3) Groundwater Monitoring

The operator shall monitor the water supply/monitoring well, Department of Water Resources Well Registry No. 55-518877, quarterly for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Static water level in the well shall be measured and recorded prior to sample pumping. If the well is used for production, pumping shall be suspended for 24 hours prior to observing the static water level. The operator shall evacuate at least one bore volume prior to sampling the monitoring well. The amount pumped shall be recorded. The water purged from the well shall be contained in the lined impoundment, stored in impervious containers, or used at the mine site.

Replace blocked area with:

The operator shall evacuate a minimum of three bore volumes or until the pH, specific conductance and temperature have stabilized within 10% for the previous three measurements, whichever represents the greater volume.

(4) Mine Inflow Monitoring

Mine inflows shall be monitored in the shaft and at the mine sump. Within the shaft, water quality and quantity shall be monitored annually from each geologic unit which continues to produce water for the parameters listed in Part II.B.2.b. Water quality analysis shall not be subject to Maximum Groundwater Limits.

Inflows within the mine shall be monitored at the mine sump for quality by quarterly sampling and analysis for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Quantity of mine inflows shall be estimated on a quarterly basis taking into account the

consumption of water by underground drilling and dust control, and the return flows from these operations. Any significant inflows shall be depicted on a mine map and submitted to ADEQ as part of the quarterly report.

c. Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

The operator shall continue to monitor the water sampling/monitoring well, Division of Water Resources Well Registry No. 55-51877 semiannually during a minimum period of fifteen (15) years for the parameters in Part II.B.2.b. The Maximum Groundwater Limits shall be those calculated for Phase II (mining) groundwater monitoring.

, with the exception of gross beta particle activity, which shall be monitored on an annual basis.

2. Constituents for Analyses

Two categories of constituents for analysis shall be used while monitoring - indicator parameters with Alert Levels and comprehensive list of parameters with Maximum Groundwater Limits:

a. Indicator Parameters

If laboratory chemical analyses for a water sample would detect concentrations of gross alpha, gross beta, and/or any of the selected trace elements in excess of the alert levels, the source for the water sample would be resampled and analyzed for the comprehensive list of parameters:

TP If the results of gross alpha particle activity exceed 15 picocuries per liter (15 pCi/L) the permittee shall determine the adjusted gross alpha particle activity, which is the measured gross alpha particle activity minus the particle activity due to uranium (total) and radon-222.

Many of post-ming monitoring gross alpha measurements suggest this was only the radium gross alpha and not the total gross alpha

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	Reserved*	1	206.2
Barium	Reserved*	2	208.1
Cadmium	Reserved*	1	213.2
Copper	Reserved*	2	220.1
Iron	Reserved*	2	236.1
Lead	Reserved*	1	239.2
Manganese	Reserved*	2	242.1
Mercury	Reserved*	1	245.1
Nitrate (as N)	Reserved*	3	---
Selenium	Reserved*	1	270.2
Silver	Reserved*	2	272.1
Zinc	Reserved*	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	Reserved*	4,13	703
Gross Beta	Reserved*	4,13	703

(1) Standard references are listed on Attachment I to this Permit.

* Reserved - Alert levels shall be established once Phase I - Premining Ambient Groundwater Characterization, has been completed and evaluated by the Department.

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved**	4	403
Arsenic	Reserved**	1	206.2
Barium	Reserved**	2	208.1
Bicarbonate	Reserved**	3	305.1
Cadmium	Reserved**	1	213.2
Calcium	Reserved**	2	215.1
Carbonate	Reserved**	4	403

(Cont'd.)

PARAMETER	MAXIMUM GROUND-WATER LIMITS	REF I.D.(1)	METHOD OF ANALYSIS
	(milligrams per liter)		
Chloride	Reserved**	3	325.3
Chromium (total)	Reserved**	1	218.2
Copper	Reserved**	2	220.1
Fluoride	Reserved**	3	340.2
Iron	Reserved**	2	236.1
Lead	Reserved**	1	239.2
Magnesium	Reserved**	2	243.1
Manganese	Reserved**	2	243.1
Mercury	Reserved**	1	245.1
Nitrate (as N)	Reserved**	3	---
Phosphate	Reserved**	4	424
Potassium	Reserved**	2	258.1
Selenium	Reserved**	1	270.2
Silver	Reserved**	2	272.1
Silica	Reserved**	-	---
Sodium	Reserved**	2	273.1
Sulfate	Reserved**	3	375.3
Total Dissolved Solids	Reserved**	3	160.3
Zinc	Reserved**	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved**	3	120.1
	(picocuries per liter)		
Gross Alpha	Reserved**	4,13	703
Gross Beta	Reserved**	4,13	703
Total Uranium	Reserved**	9,10	---
Thorium 230	Reserved**	9,10	---
Radium 226	Reserved**	4,7	705,706
Radium 228	Reserved		EPA 904

(1) Standard references are listed on Attachment I to this Permit.

** Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

(1) If a primary or secondary drinking water standard or Maximum Groundwater Limit has been established for a parameter by Arizona State regulatory agencies, and if the arithmetic mean plus two standard deviations of concentrations of the parameter in groundwater samples obtained during the pre-mining period does not exceed the drinking water standard, the Maximum Groundwater Limit shall be the drinking water standard.

If the arithmetic mean plus two standard deviations of concentrations of the parameter exceeds an established primary or secondary drinking water standard, the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of concentration of the parameter in groundwater samples.

(2) If a primary or secondary drinking water standard has not been established by the regulatory agencies for a parameter and the parameter is detected in groundwater samples during the pre-mining period, or if the arithmetic mean plus two standard deviations of concentrations in groundwater samples obtained during the pre-mining period exceeds the established drinking water standard, then the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of the pre-mining concentrations.

(3) If a parameter is not detected during the pre-mining monitoring period, and a primary or secondary drinking water standard has not been established for the parameter, the Maximum Groundwater Limit shall be twice the detection limit for the EPA laboratory method used.

3. Monitoring Forms

All monitoring results shall be recorded and reported on the Self-Monitoring Form supplied by ADEQ. This form should be given to the laboratory performing the analysis.

4. Reporting

The permittee shall submit a report summarizing progress of the mine development and monitoring results on an annual basis. The report shall contain a current site plan, a map of the underground mine workings including elevations, and shall indicate the locations of all monitoring sites required by this permit. All analytical monitoring results for the previous quarter shall be postmarked no later than

the 28th day of the second month following the completed reporting period as indicated below:

Self-Monitoring Report Forms for	are due by
1st Quarter (Jan, Feb, Mar)	May 28
2nd Quarter (Apr, May, Jun)	Aug 28
3rd Quarter (Jul, Aug, Sep)	Nov 28
4th Quarter (Oct, Nov, Dec)	Feb 28

All laboratory reports shall be submitted to the following location:

Arizona Department of Environmental Quality
OWQ - Water Pollution/UST Compliance Unit
2005 North Central Avenue
Phoenix, Arizona 85004

C. Contingency Requirements

1. Should any of the monitoring results required by this permit exceed the alert level or a Maximum Groundwater Limit specified for a particular parameter, the permittee shall immediately notify the Department of the apparent exceedance and resample to determine the validity of the sample result.

2. In the event that a confirmed exceedance of the Maximum Groundwater Limit specified in Part II.B.2.b. occurs at the monitoring well, the operator shall submit a report within 60 days which assesses the impacts from the exceedance and the mining operation.

3. In the event that the minimum freeboard requirement specified in Part II.A.1.a. is violated, the permittee shall construct an additional impoundment equivalent in construction to the lined impoundment required by Part II.A.1.a.

4. In the event that any portion of the containment system or the septic system fails, resulting in the violation of permit conditions, the owner/operator shall notify the Department's Water Pollution/UST Compliance Unit and the Mohave County Health Department immediately to determine the appropriate action to mitigate the effects of the violation.

D. Closure/Post Closure

1. The Department shall be notified in writing at least one hundred and eighty (180) days prior to closure or abandonment of the facility. The operator shall submit and have approved an updated Post-closure Plan prior to this time.

2. Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of a clay plug, a 40% clay/60% crushed shale plug or a bentonite plug in the main shaft, the air shaft and the monitoring well.

   The operator shall submit construction plans, specifications and techniques for the installation of the plugs, for the Department's approval, sixty (60) days prior to their installation.

3. Following the expiration date of this permit, the permittee shall continue monitoring listed in Part II.B.1.c. on a quarterly basis. In the event that a Maximum Groundwater Limit as described in Part II.B.2.b. is confirmed to be exceeded, the permittee shall immediately notify the Department and, within 30 days of such a violation, submit a plan to mitigate the effects of the violation.

4. In the event of abandonment, the septic tank shall have the sewage removed therefrom and be completely filled with earth, sand, gravel, or concrete. The top cover over the septic tank shall be removed before filling and the filling shall extend to the level of the top of the ground.

E. Compliance Schedule (R-20-219)

1. Within 60 days of the completion of the main shaft sinking, the operator shall submit an analysis showing that the collection sumps are impermeable and the sumps do not leak or the operator shall provide a plan for containment.

2. The operator shall notify the Water Pollution/UST Compliance Unit no less than 7 days prior to the installation of the liner specified in Part II.A.1.

(1) Discharging Monitoring

On an annual basis the effluent from the septic system from the septic system shall be sampled and analyzed for those parameters listed in Part II.B.2.b. The sampling point shall be located after the effluent flows form the septic tank and before disposal to the leach trenches.

(2) Impoundment Monitoring

The operator shall inspect the impoundment for mechanical damage, seam failure and maintenance of freeboard on a daily basis.

(3) Groundwater Monitoring

The operator shall monitor the water supply/monitoring well, Department of Water Resources Well Registry No. 55-518877, quarterly for the parameters listed in Part II.B.2.a and annually for the parameters listed in Part II.B.2.b. Static water level in the well shall be measured and recorded prior to sample pumping. If the well is used for production, pumping shall be suspended for 24 hours prior to observing the static water level. The operator shall evacuate a minimum of three bone volumes or until the pH, specific conductance and temperature have stabilized within 10% for the previous three measurements, whichever represents the greater volume.

(4) Mine Inflow Monitoring

Mine inflows shall be monitored in the shaft and at the mine sump. Within the shaft, water quality and quantity shall be monitored annually from each geologic unit which continues to produce water for the parameters listed in Part II. B.2.b. Water quality analysis shall not be subject to Maximum Groundwater Limits.

Inflows within the mine shall be monitored at the mine sump for quality by quarterly sampling and analysis for the parameters listed in Part II.B.2.a and annually for the parameters listed in Part II.B.2.b. Quantity of mine inflows shall be estimated on a quarterly basis taking into account the consumption of water by underground drilling and dust control, and the return flows from these operations. Any significant inflows shall be depicted on a mine map and submitted to ADEQ as part of the quarterly report.

c. Phase III-Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

The operator shall continue to monitor the water sampling/monitoring well, Division of Water Resources Well Registry No. 55-51887 semiannually during a minimum period of fifteen (15) years for the parameters in Part II.B.2.b., with the exception of gross beta particle activity, which shall be monitored on an annual basis. The maximum Groundwater Limits shall be those calculated for Phase II (mining) groundwater monitoring.

If the results of gross alphaparticle activity exceed 15 picocuries per liter (15 pCi/L) the permittee shall determine the adjusted gross alpha particle activity, which is the measured gross alpha particle minus the particle activity due to uranium (total) and radon-222.

2. Constituents for Analyses

Two categories of constituents for analysis shall be used while monitoring-indicator parameters with Alert Levels and comprehensive list of parameters with Maximum Groundwater Limits:

a. <u>Indicator Parameters</u>

If laboratory chemical analyses for a water sample would detect concentrations of gross alpha, gross beta, and/or any of the selected trace elements in excess of the alert levels, the source for the water sample would be resampled and analyzed for the comprehensive list of parameters:

(Cont'd.)

PARAMETER	MAXIMUM GROUND WATER LIMITS	REF I.D. ([1])	METHOD OF ANALYSIS
	(milligrams per liter)		
Chloride	Reserved**	3	325.3
Chromium(total)	Reserved**	1	218.2
Copper	Reserved**	2	220.1
Fluoride	Reserved**	3	340.2
Iron	Reserved**	2	236.1
Lead	Reserved**	1	239.1
Magnesium	Reserved**	2	243.1
Manganese	Reserved**	2	243.1
Mercury	Reserved**	1	245.1
Nitrate (as N)	Reserved**	3	-----
Phosphate	Reserved**	4	424
Potassium	Reserved**	2	258.1
Selenium	Reserved**	1	270.2
Silver	Reserved**	2	272.1
Silica	Reserved**	-	-----
Sodium	Reserved**	2	273.1
Sulfate	Reserved**	3	375.3
Total Dissolved Solids	Reserved**	3	160.3
Zinc	Reserved**	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved**	3	120.1
	(picocuries per liter)		
Gross Alpha	Reserved**	4,13	703
Gross Beta	Reserved**	4,13	703
Total Uranium	Reserved**	9,10	-----
Thorium	Reserved**	9,10	-----
Radium 226	Reserved**	4,7	705,706
Radium 228	Reserved**		EPA 904

([1]) Standard references are listed on Attachment I to this Permit.

**Reserved-Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

the 28th of the second month following the completed reporting period as indicated below:

Self-Monitoring Report Forms for		are due by
1st Quarter	(Jan, Feb, Mar)	May 28
2nd Quarter	(Apr, May,Jun)	Aug 28
3rd Quarter	(Jul, Aug, Sep)	Nov 28
4th Quarter	(Oct, Nov, Dec)	Feb 28

All laboratory reports shall be submitted to the following location:

Arizona Department of Environmental Quality
OWQ-Water Pollution/UST Compliance Unit
2005 N. Central Avenue
Phoenix, AZ 85004

C. Contingency Requirements

1. Should any of the monitoring results required by this permit exceed the alert level or a Maximum Groundwater Limit specified for a particular parameter, the permittee shall immediately notify the Department of the apparent exceedance and resample to determine the validity of the sample result.

2. In the event that a confirmed exceedance of the Maximum Groundwater Limit specified in Part II.B.2.b. occurs at the monitoring well, the operator shall submit a report within 60 days which assesses the impacts from the exceedance and the mining operation.

3. In the event that the minimum freeboard requirement specified in Part II.A.1.a is violated, the permittee shall construct an additional impoundment equivalent in construction to the lined impoundment required by Part Ii.A.1.a.

4. In the event that any portion of the containment system or the septic system fails, resulting in the violation of permit conditions, the owner/operator shall notify the Department's Water Pollution/UST Compliance Unit and the Mohave County Health Department immediately to determine the appropriate action to mitigate the effects of the violation.

D. Closure/Post Closure

1. The Department shall be notified in writing at least one hundred and eighty (180) days prior to closure or abandonment of the facility. The operator shall submit and have approved an updated Post-closure Plan prior to this time.

STATE OF ARIZONA

GROUNDWATER QUALITY PROTECTION PERMIT

Part I. AUTHORIZATION FOR FACILITY OPERATION SUCH THAT GROUNDWATER QUALITY OF THE STATE OF ARIZONA IS NOT ADVERSELY IMPACTED.

In compliance with the provisions of A.R.S. 36-1851 et seq; A.A.C. Title 9, Chapter 20, Article 2; A.A.C. Title 9, Chapter 21, Article 2; and conditions set forth in this permit:

Facility Name:	Operator:
Hermit Mine	Energy Fuels Nuclear, Inc. One Tabor Center, Suite 2500 1200 Seventeenth Street Denver, Colorado 80202

is authorized to operate the Hermit Mine, an underground uranium mine located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W 1/2 SW 1/4 - Gila and Salt River Base Line and Meridian.

This permit shall become effective on the date of signature and shall be valid for 15 years provided that the facility is operated and maintained in compliance with the specific conditions, general conditions, and information documented or referenced in Parts I, II, III and IV of this Permit and such that groundwater quality standards are not violated (Part V).

Brad L. Doores

Brad L. Doores, Vice President
Legal and Regulatory Affairs
Energy Fuels Nuclear, Inc.

Signed this 8th day of January 19 88

Ronald L. Miller, Ph.D., Assistant Director
Arizona Department of Environmental Quality

Signed this 29th day of December 19 87

Part II. SPECIFIC CONDITIONS (R9-20-208.C)

A. Disposal/Containment Requirements

1. Facility Water Containment

The facility shall be designed, constructed and maintained such that there will be no migration of wastes or pollutants either directly to groundwater or to the vadose zone.

a. The operator shall be restricted to the disposal of mine water and runoff from a 23-acre uranium mine site to a lined impoundment. All waters pumped from the underground and all runoff from the 23-acre mine operation's area shall be directed to the lined impoundment. The 12.6-acre-foot impoundment shall be lined with synthetic material equivalent to 36 mil Hypalon. The underlying surface shall contain no gravels greater than 1/4 inch. The operator shall maintain a minimum of 3-acre feet (2.4 feet) of freeboard in operating the impoundment. The operator shall maintain a reserve area for the construction of an additional lined impoundment following authorization for an increase in the mine yard disturbance area. The use of enhanced evaporation techniques shall be allowed as an alternative for controlling water level in the lined impoundment.

b. The ore storage pads shall be constructed of crushed and compacted limestone and/or shale not less than 12 inches in thickness. The ore storage pads shall be sloped toward the edges and a runoff collection structure shall be constructed to ensure that all runoff from the ore piles shall be directed to the lined impoundment.

c. The operator shall construct storm water diversion structures, as referenced in "Hydrologic Evaluations for the Proposed Hermit Uranium Mine", Dames & Moore, 1987, to control waters from no less than a 100-year, 24-hour precipitation event. The diversion structures shall be constructed from borrow material from within the operations area and shall be protected with heavy riprap. All construction shall be performed to prevent runoff from the mine operations area.

2. Sewage Disposal

The permittee is restricted to dispose the sewage generated from the travel trailers, office and host buildings into a septic tank and associated leach

lines. The septic tank, constructed in accordance with plans approved by the Mohave County Health Department, shall have a capacity of no less than 1,600 gallons and receive a maximum of 1,000 gallons per day of sewage.

3. Unauthorized Materials

   a. Materials authorized to be disposed of in the lined impoundment shall not include any materials that0 cause deterioration of the pond liner as indicated by the manufacturer's specifications for the liner material.

   b. Materials authorized to be disposed of in all septic tanks are typical household sewage and shall not include mine water, motor oil, gasoline, paints, varnishes, laboratory wastes, solvents, fertilizers, pesticides or other materials not generally associated with toilet flushing, food preparation, laundry and personal hygiene.

   c. Adequate supervision and operation shall be performed to ensure that all users of the facility are aware of and understand the containment/disposal requirements of Part II.A.1.

4. Discharge Source Limits

   Total domestic wastewater flow from the facility shall not exceed 1,000 gallons per day.

5. Mining Limit

   Total depth of the mine workings shall not exceed 1,500 feet below land surface.

6. Modification

   This permit is issued contingent upon the above conditions. The permittee shall give ninety (90) days written advance notice to the Department of any modification to the above facility.

7. Other Laws and Rules

   The operator must maintain compliance with all other State of Arizona laws and rules. The issuance of this permit does not waive any federal, state, county, or local government rules, regulations, or permits for which this facility may have to comply.

B. Monitoring Requirements, Record Keeping (R9-20-215)

1. Monitoring shall be conducted in three phases:

Phase I - Pre-Mining - Ambient Groundwater Characterization

Phase II - Mining - Evaluation of Possible Impacts

Phase III- Post-Mining - Evaluate the Effectiveness of Closure Activities.

a. Phase I - Pre-Mining

The purpose of Phase I monitoring is to determine baseline, the ambient groundwater characteristics. Ambient groundwater shall be defined as the arithmetic mean plus two standard deviations of the chemical concentrations for each parameter.

(1) The regional aquifer shall be sampled at the monitoring well, Department of Water Resources Well Registry No. 55-518877 as located at and constructed as described in Section 3.c. of the Notice of Disposal. The operator shall monitor this water supply/monitoring well quarterly for the parameters listed in Part II.B.2.b.

(2) Water producing zones shall be monitored in the shaft during shaft sinking. Water quality and quantity shall be taken from every geologic unit which produces water at the time of shaft penetration and quarterly thereafter until mining commences.

(3) Sixty (60) days after obtaining all of the Phase I water quality data as described above, the permittee shall submit a report to the Department's Water Permits Unit which summarizes the water quality data and establishes the Maximum Groundwater Limits for each sampling parameter. The Comprehensive List of Parameters listed in Part II.B.2.b. shall be utilized for this sampling report.

b. Phase II - Mining

The purpose of monitoring during the mining phase is to determine what impacts, if any, the operation is having on the groundwater quality.

(1) Discharge Monitoring

On an annual basis the effluent from the septic system shall be sampled and analyzed for those parameters listed in Part II.B.2.b. The sampling point shall be located after the effluent flows from the septic tank and before disposal to the leach trenches.

(2) Impoundment Monitoring

The operator shall inspect the impoundment for mechanical damage, seam failure and maintenance of freeboard on a daily basis.

(3) Groundwater Monitoring

The operator shall monitor the water supply/monitoring well, Department of Water Resources Well Registry No. 55-518877, quarterly for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Static water level in the well shall be measured and recorded prior to sample pumping. If the well is used for production, pumping shall be suspended for 24 hours prior to observing the static water level. The operator shall evacuate at least one bore volume prior to sampling the monitoring well. The amount pumped shall be recorded. The water purged from the well shall be contained in the lined impoundment, stored in impervious containers, or used at the mine site.

(4) Mine Inflow Monitoring

Mine inflows shall be monitored in the shaft and at the mine sump. Within the shaft, water quality and quantity shall be monitored annually from each geologic unit which continues to produce water for the parameters listed in Part II.B.2.b. Water quality analysis shall not be subject to Maximum Groundwater Limits.

Inflows within the mine shall be monitored at the mine sump for quality by quarterly sampling and analysis for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Quantity of mine inflows shall be estimated on a quarterly basis taking into account the

consumption of water by underground drilling and dust control, and the return flows from these operations. Any significant inflows shall be depicted on a mine map and submitted to ADEQ as part of the quarterly report.

c. Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

The operator shall continue to monitor the water sampling/monitoring well, Division of Water Resources Well Registry No. 55-51877 semiannually during a minimum period of fifteen (15) years for the parameters in Part II.B.2.b. The Maximum Groundwater Limits shall be those calculated for Phase II (mining) groundwater monitoring.

2. Constituents for Analyses

Two categories of constituents for analysis shall be used while monitoring - indicator parameters with Alert Levels and comprehensive list of parameters with Maximum Groundwater Limits:

a. Indicator Parameters

If laboratory chemical analyses for a water sample would detect concentrations of gross alpha, gross beta, and/or any of the selected trace elements in excess of the alert levels, the source for the water sample would be resampled and analyzed for the comprehensive list of parameters:

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	Reserved*	1	206.2
Barium	Reserved*	2	208.1
Cadmium	Reserved*	1	213.2
Copper	Reserved*	2	220.1
Iron	Reserved*	2	236.1
Lead	Reserved*	1	239.2
Manganese	Reserved*	2	242.1
Mercury	Reserved*	1	245.1
Nitrate (as N)	Reserved*	3	---
Selenium	Reserved*	1	270.2
Silver	Reserved*	2	272.1
Zinc	Reserved*	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	Reserved*	4,13	703
Gross Beta	Reserved*	4,13	703

(1) Standard references are listed on Attachment I to this Permit.

* Reserved - Alert levels shall be established once Phase I - Premining Ambient Groundwater Characterization, has been completed and evaluated by the Department.

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved**	4	403
Arsenic	Reserved**	1	206.2
Barium	Reserved**	2	208.1
Bicarbonate	Reserved**	3	305.1
Cadmium	Reserved**	1	213.2
Calcium	Reserved**	2	215.1
Carbonate	Reserved**	4	403

(Cont'd.)

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Chloride	Reserved**	3	325.3
Chromium (total)	Reserved**	1	218.2
Copper	Reserved**	2	220.1
Fluoride	Reserved**	3	340.2
Iron	Reserved**	2	236.1
Lead	Reserved**	1	239.2
Magnesium	Reserved**	2	243.1
Manganese	Reserved**	2	243.1
Mercury	Reserved**	1	245.1
Nitrate (as N)	Reserved**	3	---
Phosphate	Reserved**	4	424
Potassium	Reserved**	2	258.1
Selenium	Reserved**	1	270.2
Silver	Reserved**	2	272.1
Silica	Reserved**	-	---
Sodium	Reserved**	2	273.1
Sulfate	Reserved**	3	375.3
Total Dissolved Solids	Reserved**	3	160.3
Zinc	Reserved**	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved**	3	120.1
	(picocuries per liter)		
Gross Alpha	Reserved**	4,13	703
Gross Beta	Reserved**	4,13	703
Total Uranium	Reserved**	9,10	---
Thorium 230	Reserved**	9,10	---
Radium 226	Reserved**	4,7	705,706

(1)Standard references are listed on Attachment I to this Permit.

** Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

(1) If a primary or secondary drinking water standard or Maximum Groundwater Limit has been established for a parameter by Arizona State regulatory agencies, and if the arithmetic mean plus two standard deviations of concentrations of the parameter in groundwater samples obtained during the pre-mining period does not exceed the drinking water standard, the Maximum Groundwater Limit shall be the drinking water standard.

If the arithmetic mean plus two standard deviations of concentrations of the parameter exceeds an established primary or secondary drinking water standard, the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of concentration of the parameter in groundwater samples.

(2) If a primary or secondary drinking water standard has not been established by the regulatory agencies for a parameter and the parameter is detected in groundwater samples during the pre-mining period, or if the arithmetic mean plus two standard deviations of concentrations in groundwater samples obtained during the pre-mining period exceeds the established drinking water standard, then the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of the pre-mining concentrations.

(3) If a parameter is not detected during the pre-mining monitoring period, and a primary or secondary drinking water standard has not been established for the parameter, the Maximum Groundwater Limit shall be twice the detection limit for the EPA laboratory method used.

3. Monitoring Forms

All monitoring results shall be recorded and reported on the Self-Monitoring Form supplied by ADEQ. This form should be given to the laboratory performing the analysis.

4. Reporting

The permittee shall submit a report summarizing progress of the mine development and monitoring results on an annual basis. The report shall contain a current site plan, a map of the underground mine workings including elevations, and shall indicate the locations of all monitoring sites required by this permit. All analytical monitoring results for the previous quarter shall be postmarked no later than

the 28th day of the second month following the completed reporting period as indicated below:

Self-Monitoring Report Forms for	are due by
1st Quarter (Jan, Feb, Mar)	May 28
2nd Quarter (Apr, May, Jun)	Aug 28
3rd Quarter (Jul, Aug, Sep)	Nov 28
4th Quarter (Oct, Nov, Dec)	Feb 28

All laboratory reports shall be submitted to the following location:

Arizona Department of Environmental Quality
OWQ - Water Pollution/UST Compliance Unit
2005 North Central Avenue
Phoenix, Arizona 85004

C. Contingency Requirements

1. Should any of the monitoring results required by this permit exceed the alert level specified for a particular parameter, the permittee shall immediately notify the Department of the apparent exceedance and resample to determine the validity of the sample result.

2. In the event that a confirmed exceedance of the Maximum Groundwater Limit specified in Part II.B.2.b. occurs at the monitoring well, the operator shall submit a report within 60 days which assesses the impacts from the exceedance and the mining operation.

3. In the event that the minimum freeboard requirement specified in Part II.A.1.a. is violated, the permittee shall construct an additional impoundment equivalent in construction to the lined impoundment required by Part II.A.1.a.

4. In the event that any portion of the containment system or the septic system fails, resulting in the violation of permit conditions, the owner/operator shall notify the Department's Water Pollution/UST Compliance Unit and the Mohave County Health Department immediately to determine the appropriate action to mitigate the effects of the violation.

D. Closure/Post Closure

1. The Department shall be notified in writing at least one hundred and eighty (180) days prior to closure or abandonment of the facility. The operator shall submit and have approved an updated Post-closure Plan prior to this time.

2. Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of a clay plug, a 40% clay/60% crushed shale plug or a bentonite plug in the main shaft, the air shaft and the monitoring well.

   The operator shall submit construction plans, specifications and techniques for the installation of the plugs, for the Department's approval, sixty (60) days prior to their installation.

3. Following the expiration date of this permit, the permittee shall continue monitoring listed in Part II.B.1.c. on a quarterly basis. In the event that a Maximum Groundwater Limit as described in Part II.B.2.b. is confirmed to be exceeded, the permittee shall immediately notify the Department and, within 30 days of such a violation, submit a plan to mitigate the effects of the violation.

4. In the event of abandonment, the septic tank shall have the sewage removed therefrom and be completely filled with earth, sand, gravel, or concrete. The top cover over the septic tank shall be removed before filling and the filling shall extend to the level of the top of the ground.

E. Compliance Schedule (R-20-219)

1. Within 60 days of the completion of the main shaft sinking, the operator shall submit an analysis showing that the collection sumps are impermeable and the sumps do not leak or the operator shall provide a plan for containment.

2. The operator shall notify the Water Pollution/UST Compliance Unit no less than 7 days prior to the installation of the liner specified in Part II.A.1.

Part III. REFERENCES: PERTINENT INFORMATION

A. References

The terms and conditions set forth in this permit have been developed based upon the information contained in the following:

1. Groundwater Field Inspection Form(s) dated _____

2. Notice of Disposal dated June 14, 1987

3. Groundwater Impact Review dated August 4, 1987

4. Plan Review File Number _____

5. Permit Application dated _____

6. Groundwater Impact Review dated _____

7. Amendments to 2 and 4 dated _____

8. Public Notice dated September 14, 1987

9. Public Hearing comments, correspondence letters, and any additional supplemental information contained in the facility permit file.

10. Other _____

B. Facility Information

1. Facility Contact Person Roger Smith

2. Address Energy Fuel Nuclear, Inc.
P. O. Box 36
Fredonia, AZ 86022

3. Emergency Telephone Number: Business (602) 643-7321
Home ( )

The Department shall be notified within 30 days of a change in the facility contact person.

4. Landowner of Facility Site B. L. M.

C. Definitions

1. "Abandoned" means permanent cessation of facility operation, as determined by the facility owner. Facilities which are temporarily shut down are not considered abandoned within the context of these regulations.

2. "Activity" means any human activity including institutional, commercial, manufacturing, extraction, agricultural, or residential land use which may involve disposal of wastes or pollutants which may result in pollution of groundwaters of the State.

3. "Adverse impact upon groundwater quality" means any measurable change to the physical, chemical or biological character of groundwater caused by addition of pollutants or wastes.

4. "Approved" or "approval" means approved in writing by the Director.

5. "Aquifer" means a geologic unit that contains saturated permeable material to yield usable (drinking water, agriculture, industry, etc.) quantities of water to a well or spring.

6. "Composite sample" means a combination of 4 individual portions obtained at equal time intervals for 1 hour. The volume of each individual portion shall be directly proportional to the discharge flow rate at the time of sampling. The sampling period shall coincide with the period of maximum discharge flow.

7. "Department" means the Arizona Department of Environmental Quality (ADEQ).

8. "Director" means the Director of the Arizona Department of Environmental Quality or his duly authorized representative.

9. "Discharge" means the addition, spilling, leaking, pumping, pouring, emitting or dumping of any pollutant into waters of the State from any point source.

10. "Discharge Impact Area" means the potential area extent of waste or pollutant migration, as projected on the land surface, as a result of a discharge or disposal from a facility.

11. "Discrete sample" means any individual sample collected in less than 15 minutes.

12. "Disposal" means the discharge, deposit, well injection, dumping, spilling, leaking, or placing of any wastes or pollutants into or on any land or water such that groundwater is or may be affected. For the purposes of this Article, irrigation with effluent from a wastewater treatment facility is disposal if the application rate exceeds that amount necessary to satisfy the consumptive use and leaching requirements of the crop or landscaping being irrigated.

13. "Disposal system" means a system for disposing of wastes either by surface or underground methods and includes sewerage systems, treatment works, disposal wells and other systems.

14. "Facility" means any system or activity in which or by which disposal occurs or has occurred on either a continuous or intermittent basis.

15. "Flow rate" means the volume per unit time given to the flow of fluids.

16. "Geologic unit" means a geologic formation, group of formations, or part of a formation.

17. "Groundwater" means water under the surface of the earth regardless of the geologic structure in which it is standing or moving. Groundwater does not include water flowing in underground streams with ascertainable beds and banks.

18. "Groundwater Quality Standards" means the standards in A.A.C. R9-21-403.

19. "Hazardous waste" means a waste as defined by the Federal Resource Conservation and Recovery Act (P.L. 94-580).

20. "Hydraulic conductivity" means a measure of the capability of a geologic unit to transmit a fluid.

21. "Individual disposal system" means a device or system for the treatment or disposal of sewage from a single housing unit or equivalent.

22. "Maximum Disposal Limit (MDL)" means the maximum permissible level for a contaminant in an effluent stream.

23. "Maximum Groundwater Limit (MGL)" means the maximum permissible level for a contaminant in water.

24. "Modification" means a change in the location, volume, constituent(s) or constituent concentration(s) of a disposal which is described in the permit issued pursuant to R9-20-208.

25. "Operator" means any person who makes management decisions regarding facility operations.

26. "Owner" means any person holding legal or equitable title in any real property subject to these regulations.

27. "Permit" means a rule, certificate, letter, or any other document issued by the Director authorizing and conditioning the discharge of any pollutant to groundwater from any point source or disposal of wastes from any disposal system identified in A.R.S. Sec. 36-136.G.8.

28. "Pollute" means to cause pollution.

29. "Regulations" means A.A.C. Title 9, Chapter 20, Article 2, requirements for facilities affecting groundwater quality.

30. "Schedule of compliance" or "compliance schedule" means a written document issued by the Director which identifies requirements and times for compliance with either or both the water quality standards in A.A.C. Title 9, Chapter 21 or the permit regulations in A.A.C. Title 9, Chapter 20.

31. "Sewage" means wastes from toilets, baths, sinks, lavatories, laundries and other plumbing fixtures in residences, and wastes from institutions, commercial buildings, mobile homes and other places of human habitation, employment or recreation which are similar in content to residential wastes.

32. "Site" means the area where any facility is physically located or an activity is conducted, including adjacent land used in connection with the facility.

33. "Treatment works" means any plant or other works used for the purpose of treating, stabilizing, or holding wastes.

34. "Vadose zone" means the zone between the land surface and the principle zone of saturation.

Part IV. GENERAL CONDITIONS: RESPONSIBILITIES

A. Permit Duration (R9-20-210)

1. Permits shall be valid for the expected operational life of the facility under the ownership as set forth in the permit unless otherwise limited by Federal or State statute or transferred pursuant to R9-20-221.C.

2. A permit may be modified or terminated pursuant to R9-20-221.

3. The owner or operator of the facility may request that a permit be issued for a duration that is less than the full allowable term.

B. Permit Rights (R9-20-214)

1. A permit does not convey any property or water right of any sort, or any exclusive privilege.

2. A permit does not authorize any injury to persons or property or invasion of other private rights, or any infringement of Federal, State, or local laws or regulations.

C. Monitoring Requirements; Record Keeping (R9-20-215)

1. The permittee shall implement and maintain an approved monitoring system if required as a condition of a permit.

a. The permittee shall install, use and maintain all monitoring equipment in acceptable condition or provide alternate methods approved by the Department.

b. The permittee is required to conduct monitoring of a type and frequency sufficient to yield data which are representative of the monitored activity.

2. The permittee shall retain records or have access to all monitoring information, for a period of at least three (3) years from the date of the sample, or measurement. This period may be extended by written request of the Department at any time. Copies of records shall be furnished to the Department upon written request.

a. Records of monitoring information shall include but are not limited to the following:

(1) The date, time, exact place, and name of individual(s) who performed the sampling or measuring;

(2) the date(s) of, and name(s) of the individual(s) who performed the analyses; and

(3) the analytical techniques or methods used to perform the analyses.

b. Monitoring results shall be reported at intervals specified in the permit.

c. Calculations which require the averaging of measurements shall utilize an arithmetic mean unless it can be demonstrated by the permittee that another method would more accurately describe or be representative of the monitored activity.

3. Information submitted as a result of any well boring shall include a complete driller's log and drawings showing details of the well's construction. If information must be submitted more than once for the same well, then subsequent submittals shall note that the driller's log and construction drawings have already been submitted and the date of the initial submittal shall be documented.

D. Reporting Requirements (R9-20-216)

1. The permittee shall give ninety (90) days written advance notice to the Department of any modification to the facility which is not described in the approved Notice of Disposal or permit application.

2. The permittee shall notify the Department within seventy two (72) hours of becoming aware of any permit violation. The Department may require the permittee to submit a written report within thirty (30) days documenting the following:

a. A description of the noncompliance and its cause;

b. the period of noncompliance, including exact date(s) and time(s), and the anticipated time period during which the noncompliance is expected to continue if it has not been completely corrected;

c. action taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance: If applicable, such action shall be in accordance with an approved contingency plan;

d. monitoring or other information which indicates that any waste or pollutant may cause an endangerment to an aquifer; and

e. noncompliance with a permit condition, or malfunction of the disposal system which may cause fluid migration into or between aquifers.

3. The Department shall be notified in writing at least one hundred eighty (180) days prior to abandonment of the facility.

a. The permittee may be required to submit a detailed post-closure plan to the Department for approval which shall describe what the physical condition of the facility will be on the date operations are terminated.

b. The Department may require the post-closure plan to include any or all of the following:

(1) A description of monitoring procedures to be implemented by the permittee including monitoring frequency, type, and location which will be implemented to ensure post-closure activities will not violate groundwater quality standards;

(2) a description of procedures for maintaining existing groundwater quality protection systems;

(3) a schedule and description of physical inspections to be conducted at the facility following abandonment;

(4) a description of future land or water uses or both which may be precluded as a result of facility abandonment; and

(5) identification of responsibilities for post-closure cleanup or remedial action in the event of pollution of waters of the State.

E. Site Examination (R9-20-217)

1. The Department may routinely inspect the facility or an activity used for the generation, storage, treatment, collection, or disposal of any waste or pollutant, and where records are kept, for the purpose of determining compliance with these regulations or water quality standards, or verifying information submitted in a Notice of Disposal, or permit application, or documented in a permit including any permit conditions.

2. The Department may:

a. Obtain samples of wastes or pollutants;

b. analyze or cause to be analyzed any samples either on site or at another location;

c. take photographs of waste and equipment processes and conditions at the site; or

d. inspect and copy any pertinent records, reports, information, and test results.

3. Any pertinent information required by the permit to be maintained by the permittee shall be available for on-site inspection during normal business hours. Split samples and copies of photographs will be provided to the facility owner or operator if the owner or operator requests them at the time the sample(s) is obtained or the photograph(s) is taken as the case may be.

4. Inspections shall be conducted pursuant to the appropriate provisions of the Arizona Revised Statutes and policies established by the Department.

F. Proper Operation and Maintenance (R9-20-218)

The permittee shall at all times maintain in good working order and operate properly all treatment works installed or used for water pollution control and abatement to achieve compliance with the terms and conditions of the permit and water quality standards. If required by Article 5 of A.A.C. Title 9, Chapter 20, the permittee shall retain the services of an operator certified by the Department at the level appropriate to the permitted facility.

G. Permit Conditions (R9-20-220)

1. Duty to Mitigate

The permittee shall take all steps to minimize and correct any adverse impact on groundwater quality as defined in A.A.C. Title 9, Chapters 20 and 21 resulting from noncompliance with the permit.

2. Duty to Reapply

If a permittee has not been issued a permit for the life of the facility, a renewal application in the form of an amended Notice of Disposal or permit application shall be submitted to the Department no less than one hundred eighty (180) days prior to expiration of the existing permit.

3. Duty to Comply

The permittee shall comply with all terms and conditions

of the permit, and take such action as is necessary to ensure compliance.

H. Permit Actions (R9-20-221)

1. This permit may be modified, transferred, renewed, or revoked for cause. The filing of a request by the permittee for a permit action does not stay any existing permit condition.

2. Permit Modification

a. Request for modification of a permit may be made by the permittee, the Department, or any affected person and shall identify the specific item(s) to be considered for modification.

b. Public requests for modification of a permit shall be in writing to the Department and shall contain technical facts or reasons which justify the requested changes. The Department upon receipt of the request will notify the permittee, and evaluate and determine whether any request for modification shall be granted.

c. The permittee may be required to submit additional information, including an updated Notice of Disposal or permit application.

d. Only those items considered for modification may be changed, and all other conditions of the existing permit will remain in effect.

e. The following circumstances and occurrences shall require modification of a permit:

(1) Modification to the facility, which justify application of permit conditions that are different from or absent in the existing permit;

(2) other information that was not available when the existing permit was issued, and which justifies application of different permit conditions;

(3) changes in the regulations or standards upon which the permit was based which have been made after the permit was issued;

(4) good cause exists for changes in a compliance schedule because of conditions over which the permittee has little or no control, and a change to the permit by

modification is a reasonable remedy;

(5) reason(s) exists for revocation of the permit, and the Department determines that modification is an appropriate method for change; and

(6) amendment to an approved abandonment plan or contingency plan or any other portion of an approved Notice of Disposal or permit application.

f. The suitability of the location of the facility will not be reconsidered during the process of changing the permit unless new information or change to regulations indicate that a violation of adopted groundwater quality standards exist and no other action is possible to mitigate the violation and comply with groundwater quality standards.

g. The Department will publish a notice of intent pursuant to R9-20-223 to modify a permit before any final action is taken.

h. With the concurrence of the permittee, the Department may make minor modifications to a permit for any of the following reasons:

(1) To correct typographical errors;

(2) to require more or less frequent monitoring or reporting by the permittee;

(3) to change an interim compliance date in a schedule of compliance, provided the new date is not more than sixty (60) days after the date specified in the existing permit, and does not interfere with attainment of the final compliance date requirement;

(4) to change quantities or types of fluids discharged which are within the capacity of the facility as permitted, and in the judgment of the Department would not interfere with the operation of the facility or its ability to meet conditions prescribed in the permit, and would not change its classification, if the facility is an injection well; or

(5) to change construction requirements approved by the Department, provided that any such alteration shall comply with the requirements of these regulations.

3. Permit Transfer

a. This permit is transferrable to any person after thirty (30) days advance written notice to the Department. The Department may require modification of the permit to change the name of the permittee and incorporate any requirements which may be necessary to ensure compliance with State statutes and regulations.

b. The permittee shall notify by registered letter a new owner or operator of a permitted facility of the existence of the permit thirty (30) days prior to transfer of responsibility. The notice shall include a copy of the permit. A copy of the letter shall be transmitted to the Department.

c. The new owner or operator shall be responsible for compliance with the permit upon transfer of ownership or operation without regard to whether said owner or operator has in fact received the notice required by R9-20-221.C.2.

d. Permit transfer does not absolve the previous permittee of any liability existing at or before the time the permit was transferred.

4. Permit Revocation

a. Request for revocation of a permit may be made by the permittee, Department, or any affected person.

b. Public requests for permit revocation shall be in writing to the Department and shall contain technical facts or reasons which justify the requested action. The Department upon receipt of the request will notify the permittee and evaluate the request and determine whether any request for revocation should be granted.

c. Revocation of a permit is initiated when the Department issues a notice of intent to revoke a permit pursuant to R9-20-223 to the permittee and may be initiated for the following reasons:

(1) Noncompliance by the permittee with any permit condition;

(2) deliberate failure by the permittee to fully disclose all relevant facts when applying for a permit;

(3) intentional or deliberate misrepresentation of any relevant fact at any time by the permittee; or

(4) if it is determined by ADEQ that the permitted activity is causing a violation of groundwater quality standards and such violation can only be regulated to acceptable levels by revoking the permit.

d. If disposal to an aquifer causes a clear, present, and immediate danger to the health or welfare of persons, the Department may immediately suspend a permit. Within fourteen (14) days of the suspension, the Department shall issue a notice of intent to revoke the permit. The permit shall be considered revoked thirty (30) days after the notice of intent is issued by the Department unless and until a hearing is requested by the permittee pursuant to R9-20-222.

I. Confidentiality of Information (R9-20-224)

1. Any information submitted to or obtained by the Department pursuant to these regulations may be claimed as confidential by the facility owner or operator. Any such claim shall be asserted at the time the information is submitted or obtained. If no claim is made at that time, the Department may make the information available to the public without further notice.

2. Claims of confidentiality for the following information shall be denied:

a. The name and address of any permit applicant or permittee; or

b. information which deals with the present or future existence, absence, or level of waste(s) or pollutant(s) in water.

3. Criteria for determining confidentiality are:

a. A confidentiality claim has been made at the time the information was submitted or obtained;

b. the facility owner or operator has shown that reasonable measures have been taken to protect the confidentiality of the information, and intends to continue to take such measures;

c. the information is not, and has not been, reasonably obtainable without the facility owner or operator's consent;

d. no statute specifically requires disclosure of the information; and

e. the facility owner or operator has shown that disclosure of the information is likely to cause harm to it's competitive position; or, the information is voluntarily submitted and disclosure would be likely to impair the State's ability to obtain necessary information in the future.

J. Enforcement and Penalties (R9-20-225)

Any person who constructs, operates, or maintains a facility, disposal system, or introduces wastes or pollutants to waters of the State contrary to the provisions of this permit, falsifies data or information submitted to the Department as a result of the requirements of this permit, or otherwise violates the provisions of this permit, shall be subject to enforcement and penalties pursuant but not limited to A.R.S. 36-1864.01.

PART V. GROUNDWATER QUALITY STANDARDS

A. General Standards Applicable to all Groundwaters (R9-21-403)

1. Discharges of any pollutants and disposal of any wastes shall not impair the uses which have been made, are being made, or will be made of groundwater for every purpose.

2. Discharges of any pollutants and disposal of any wastes to groundwaters of the State shall not cause a public health hazard.

3. Disposal of any hazardous waste, radioactive waste or other waste shall not cause toxic substances to be present in groundwaters of the State in concentrations which are or may be hazardous to public health or which interfere with present and future uses of the groundwater.

4. Discharges of any pollutants and disposal of any wastes to groundwaters of the State shall not directly or indirectly cause violation of surface water quality standards established pursuant to Article 2 of this chapter.

ATTACHMENT I

Permit No. G-0035-08

REFERENCE

1. Flameless A.A., Methods for Chemical Analysis of Water and Wastes, 1980. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268 March 1983.

2. Flame A.A., Methods for Chemical Analysis of Water and Wastes, 1980. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268, March 1983.

3. Methods for Chemical Analysis of Water and Wastes, 1980. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268, March 1983.

4. Standard Methods for the Examination of Water and Wastewater, 16th ed., American Public Health Assoc., 1975.

5. Methods for Determination of Radioactive Substances in Water and Fluvial Sediments, Techniques of Water Resources Investigations of the U.S. Geological Survey, Chapter A5, 1977.

6. Quantitative Radiochemical Method for Determination of Major Sources of Natural Radioactivity in Ores and Minerals, p. 1307, ACS, Aug. 1954; and p. 1398, ACS, Oct. 1957, N.J. Rosholt, Jr.

7. The Determination of Radium-226 in Uranium Ores and Mill Products by Alpha Energy Spectrometry, Canmet Report 76-11, Canadian Centre for Mineral and Energy Technology.

8. Analytical Method for the Determination of Polonium 210, Thorium 230 in Uranium Ore, Concentrates, and Plant Liquors, PG report 356(s), United Kingdom Atomic Energy Authority.

9. Microquantities of Uranium in Water by Flourimetry, Annual Book of ASTM Standards, 1973, (D2907) 23.

10. Manual of Analytical Methods for the Uranium Concentrating Plant, Mines Branch Monograph 866, Dept. of Mines and Technical Surveys, Ottawa, Canada, (1959).

11. Handbook of Analytical Procedures, J.M. Latimer, et al, ROM-3008, USAEC, Grand Junction Office, Analytical Laboratory, February, 1970.

12. Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032, 1980. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268.

13. Interim Radiochemical Methods for Drinking Water, EPA-600/4-75-008, March 1976. Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, OH 45268.

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	0.025	1	206.2
Barium	0.5	2	208.1
Cadmium	0.005	1	213.2
Copper	0.5	2	220.1
Iron	0.15	2	236.1
Lead	0.025	1	239.2
Manganese	Reserved*	2	242.1
Mercury	0.001	1	245.1
Nitrate (as N)	5.0	3	---
Selenium	0.005	1	270.2
Silver	0.025	2	272.1
Zinc	5.0	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	5.0	4,13	703
Gross Beta	5.0	4,13	703

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved*	4	403
Arsenic	0.05	1	206.2
Barium	1.0	2	208.1
Bicarbonate	Reserved*	3	305.1
Cadmium	0.010	1	213.2
Calcium	Reserved*	2	215.1
Carbonate	Reserved*	4	403
Chloride	Reserved*	3	325.3
Chromium (total)	0.05	1	218.2
Copper	1.0	2	220.1

(1) Standard references are listed on Attachment I to this Permit.

These 2 pages were substituted on Oct. 12, 1988. Original

(Continued)

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Fluoride	2.4	3	340.2
Iron	0.3	2	236.1
Lead	0.05	1	239.2
Magnesium	Reserved*	2	243.1
Manganese	Reserved*	2	243.1
Mercury	0.002	1	245.1
Nitrate (as N)	10.0	3	---
Phosphate	Reserved*	4	424
Potassium	Reserved*	2	258.1
Selenium	0.01	1	270.2
Silver	0.05	2	272.1
Silica	Reserved*	-	---
Sodium	Reserved*	2	273.1
Sulfate	Reserved*	3	375.3
Total Dissolved Solids	Reserved*	3	160.3
Zinc	Reserved*	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved*	3	120.1
	(picocuries per liter)		
Gross Alpha	15	4,13	703
Why is the Gross Beta higher than the Gross Alpha? Gross Beta	50	4,13	703
Total Uranium	Reserved*	9,10	---
Thorium 230	Reserved*	9,10	---
Radium 226	Reserved*	4,7	705,706

(1) Standard references are listed on Attachment I to this Permit.

* Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

PERMITS

RECORD NO 12

2 PERMIT # G-0035-08 1 PRTY PTS ~~272~~

3 FACILITY NAME Hermit Mines

4 FACILITY NAME 2 Energy Fuels Nuclear, Inc.

5 ADDRESS 1200 Seventeenth St.

6 CITY, STATE, ZIP Denver, Colorado 80202 7 PHONE

8 TYPE NEW New

9 CONTACT NAME Roger Smith

10 CONTACT PHONE (602) 643-7321

11 APP REQ'D N

12 TYPE OF FAC ~~Underground uranium~~ mine

13 REUSE N

14 LOCATION 21 miles south of Fredonia, AZ

15 TRS 38N, 4W, 17 16 GW BASIN/AMA Kanab Plateau Basin

17 DATE SIGNED 12/29/87 18 YR 87 19 EXP OF PERMIT 15 years

20 MONITORING

21 FREQUENCY (Pre-Mining - Quarterly, ~~Aquifer Test~~ Mining - Annually, Post-Mining Semi-Annual (5 years))

22 MGL (~~Mill MDL~~ Mill) 24 SW

25 MON 1 Arsenic, Barium, Cadmium, Copper, Iron, Lead, Manganese, Mercury,

26 MON 2 Nitrate, Selenium, Silver, Zinc, Carbonate, Bicarbonate, Calcium,

27 MON 3 Chloride, Chromium, Fluoride, Iron, Lead, Magnesium, Manganese,

28 MON 4 Mercury, Nitrate, Phosphate, Potassium, Selenium, Silver, Silica,

29 MON 5 Sodium, Sulfate, Tot. Dissolved Solids, Zinc)

30 FEET TO GW

31 FLOW (MGD)

32 ACRES ~~23 acre~~

33 G/D/A

34 DISPOSAL METH ~~lined impoundment~~ Non-Discharge

35 MISC.

36 PERMIT WRITER Miguel Santiago

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Jane Dee Hull, Governor John Hagen, Acting Director

STATE OF ARIZONA

Aquifer Protection Program
Clean Closure Approval
Groundwater Quality Protection Permit No. G-0035-08

Facility Name: **Hermit Mine**

Owner and Operator: **International Uranium (USA) Corporation**
Independence Plaza, Suite 950
1050 Seventeenth Street
Denver, Colorado 80265

has completed the clean closure of a mining facility located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W½ SW¼ - Gila and Salt River baseline and meridian.

Latitude 36° 41' 25" North
Longitude 112° 45' 03" West

Groundwater Quality Protection Permit (GWQPP) No. G-0035-08 was issued on or about January 8, 1988 to Energy Fuels Nuclear Inc. (EFN). The permit was transferred to International Uranium (USA) Corporation (IUSA) on or about April 18, 1997. The permit authorized operation of an underground uranium mine. On February 19, 1990, EFN, predecessor to IUSA, notified the Arizona Department of Environmental Quality (ADEQ), Water Permits Unit, that mining operations had ceased and implementation of the preliminary steps to final closure of the facility had begun. Physical closure of the facility was completed in 1990. A closure report was submitted on December 24, 1998. Addendums to the report were submitted January 15, 1999 and February 1, 1999. The closure report and addendums indicate that the closure was completed pursuant to the conditions of GWQPP No. G-0035-08. The Water Permits Section of the ADEQ has determined that the closure has eliminated to the greatest degree practicable, any reasonable probability that any discharges from the facility have not and will not cause an exceedence of aquifer water quality standards at the applicable point of compliance. This determination is based on site analytical data. Post-closure monitoring and maintenance are not necessary to meet the requirements of Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2. The facility has met the clean closure criteria pursuant to A.R.S. § 49-201.5. In accordance with A.R.S. § 252.D., an Aquifer Protection Permit is not required. This letter authorizes the clean closure of GWQPP No. G-0035-08.

ADEQ may withdraw this decision if the provided information is found to be inaccurate. Further, this letter is not intended to waive any other federal, state or local requirements that may apply to this facility.

Karen L. Smith, Ph.D.
Director, Water Quality Division
Arizona Department of Environmental Quality
Signed this 25th day of February, 1999

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Jane Dee Hull, Governor John Hagen, Acting Director

EXECUTIVE SUMMARY
CLEAN CLOSURE APPROVAL
GROUNDWATER QUALITY PROTECTION PERMIT NO. G-0035-08

Facility Name:

International Uranium (USA) Corporation Hermit Mine

Facility Location:

The facility is located approximately 21 miles south of Fredonia (in Mohave County), Arizona over the groundwaters of the Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, West ½ and Southwest ¼ - Gila and Salt River baseline and meridian.

Regulatory Status:

A Notice of Disposal form was submitted by Energy Fuels Nuclear, Inc. (EFN) to the Arizona Department of Environmental Quality (ADEQ) on June 14, 1987. A Plan of Operations, dated February 1987, was approved by the BLM during 1987 and submitted to ADEQ. GWQPP No. G-0035-08 was issued to EFN on January 8, 1988. On February 19, 1990, EFN notified the ADEQ that mining operations had ceased and implementation of the preliminary steps to final closure of the facility had begun. A request for transfer of the permit from EFN to International Uranium (USA) Corporation (IUSA) was submitted to ADEQ on February 4, 1997. The permit was transferred to IUSA on or about April 18, 1997. During a meeting with ADEQ on November 10, 1998, IUSA informed ADEQ the mine was closed and reclaimed. ADEQ determined that the facility may be eligible for clean closure pursuant to A.R.S. § 49-241.01.A., and requested that IUSA submit a closure report for the facility. On December 24, 1998, a closure report was submitted. Addendums to that report were submitted January 15, 1999 and Febuary 1, 1999.

Facility Description:

The Hermit Mine operated as an underground uranium mine. The 23.6 acre facility consisted of mine workings to a depth of 1,130 feet below ground surface, stockpiling of ore grade material on ore pads, collection and evaporation of mine water and surface facility runoff in 2 lined surface impoundments, and routine operational and maintenance activities associated with operations of this nature. No chemical processing of ore occurred at the facility. Ore grade material produced was transported to the White Mesa Uranium Mill located near Blanding, Utah for processing.

Surface facilities were situated at an elevation of approximately 4,900 feet. The regional groundwater table,

which is within the Redwall-Muav limestone aquifer, is at a depth greater than 2,000 feet. The deepest mine workings are approximately 1,000 feet above the aquifer.

Facility History:

	1988	Construction of the mine began with the establishment of surface facilities.
	1989	The underground development was completed.
June	1989	Mining commenced in June of 1989.
January	1990	Mining ceased in January of 1990. Approximately 32,000 tons of uranium ore were mined containing approximately 500,000 pounds of uranium oxide.
September	1990	Closure and reclamation activities began pursuant to Groundwater Quality Protection Permit (GWQPP) No. G-0035-08 and the United States Bureau of Land Management (BLM) Plan of Operations.
December	1994	Closure and site reclamation completed.

Compliance with Maximum Groundwater Limits:

On February 14, 1990 EFN submitted the Hermit Mine Premining Water Quality Report. Five quarterly samples were collected and analyzed from the monitoring/production well. EFN calculated and established Maximum Groundwater Limits for the mining phase in accordance with the GWQPP. However, numeric values were not implemented into the GWQPP by ADEQ. All values remained "Reserved" in the GWQPP.

EFN also submitted the Hermit Mine Groundwater Monitoring Report Mining Phase on February 14, 1990. In this report, EFN indicates that mining phase water quality results indicated that certain concentrations exceeded MGL's as determined following the procedures in the GWQPP. The report provided initial possible explanations for the exceedences and outlined a plan for further investigation into them.

On July 5, 1990, EFN provided 1st and 2nd quarter groundwater monitoring results and notified ADEQ that there were some exceedences in Maximum Groundwater Limits. On June 7, 1990 ADEQ received a report from EFN, Water Quality Evaluation Hermit Mine Site, conducted by consultant Canonie Environmental Services Corp. Their report concludes that exceedences for water samples were not caused by seepage from the mine. A review of the report was conducted by ADEQ Hydrologist Jim DuBois. In an internal memorandum he also concluded that from the data presented, the facility had not caused or contributed to exceedence of numeric Aquifer Water Quality Standards (AWQS) at the point of compliance. He also believed that the exceedences of MGL's for certain constituents at levels slightly above the specified MGL was caused because ambient concentrations of those constituents were not adequately defined before permitting the facility. An April 9, 1992 letter sent to EFN by ADEQ indicated agreement that the mine sump was not the cause of exceedences of permit MGL's, and that ADEQ would not recommend any further compliance action.

Review of post-mining water quality analysis results do not indicate that the mining operation has resulted in exceedences in AWQS. The facility is closed, and potential sources of pollutants have been removed.

Monitoring Requirements:

GWQPP No. G-0035-08 required a post-mining monitoring period of a minimum of 15 years. The monitoring well has been monitored on a semi-annual basis during the post-mining period for the past 8 years. A review of those monitoring results indicates no significant variations in pollutant values. Pursuant to A.R.S. § 49-252.D., and the definition provided in A.R.S. § 49-201.5., no postclosure monitoring and maintenance will be required.

Point of Compliance:

The designated point of compliance is the monitoring well, Division of Water Resources Well Registry No. 55-518877. Latitude 36° 41' 21" North, Longitude 112° 45' 04" West. Monitoring at the point of compliance is not required. In accordance with the GWQPP, IUSA will consult with the land manager, BLM, determine the potential usefulness of the well, and either seal the well or convey it to BLM.

Storm/Surface Water Considerations:

EFN had completed reclamation of the area of operations in accordance with the GWQPP, which references the BLM approved Plan of Operations, with the exception of a small area where the lined surface impoundments were located. IUSA intends to gain authorization from BLM to borrow material from this area to be used for reclamation of the nearby Kanab North Mine site in the future, and to provide a stock tank for a cattle ranch permittee. If BLM does not grant IUSA authorization, this area will be reclaimed accordingly. Reclamation of the area of operations, which included stormwater diversion structures, included re-contouring, re-topsoiling, drill seeding and performing a radiometric survey, was in accordance with the BLM approved Plan of Operations. Because there are no longer any mining operations occurring, no additional controls are required.

Conclusion:

A clean closure approval can be issued as the facility has met clean closure criteria pursuant to A.R.S. § 49-201.5.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Governor Jane Dee Hull John F. Hagen, Acting Director

MU99:0057 **Inventory Number: 100299**

March 2, 1999

Donn M. Pillmore, Project Manager
International Uranium (USA) Corporation
H.C. 64, Box 153
2555 No. Highway 89A
Fredonia, AZ 86022

Subject: Hermit Mine Clean Closure - Clean Closure Approval

Enclosed is a signed copy of the Aquifer Protection Program, Clean Closure Approval and Executive Summary for the Hermit Mine located approximately 21 miles south of Fredonia, Mohave County, Arizona. Please contact me at (602) 207-4789 if you have any questions.

Sincerely,

Craig DeWalt

Craig DeWalt, Project Officer
Water Permits Section, Mining Unit

Enclosure

CD:cd

c: Don Shroyer, Manager, Water Quality Data Unit
Lynne Dekarske, Administration, Water Permits Section
Dennis L. Turner, Supervisor, Mining Unit
Jerry Breckenridge, ADEQ, Northern Regional Office
Bureau of Land Management, Arizona Strip District

TRANSFER AND MODIFICATION OF GROUNDWATER QUALITY PROTECTION PERMIT NO. G-0035-08

Facility Name: Hermit Mine

Responsibility for the compliance with all requirements of Groundwater Quality Protection Program permit G-0035-08 is hereby transferred to the following applicant:

Former Owner & Operator:

Energy Fuels Nuclear, Inc.
Three Park Central, Suite 900
1515 Arapahoe St.
Denver, CO 80202

Current Owner & Operator:

International Uranium (USA) Corporation
950 Independence Plaza
1050 17th Street
Denver, CO 80202

1. Strike former owner and operator in Part I and replace with current owner and operator as shown below:

International Uranium (USA) Corporation
950 Independence Plaza
1050 17th Street
Denver, CO 80202

2. On permit cover page strike "*groundwater quality standards*" and replace with the following:

Aquifer Water Quality Standards (AWQS)

3. Strike former contact person in Part III and replace with current contact person as shown below:

Michelle R. Rehmann, Env. Mgr.
950 Independence Plaza
1050 17th Street
Denver, CO 80202
(303) 628-7798

This transfer and modification shall become effective on the date of signature and shall be valid for the duration of the permit provided that the facility is constructed, operated, and maintained pursuant to all the conditions of this permit, according to the design and operational information documented or referenced in PARTS I, II, III, and IV of the permit, and such that Aquifer Water Quality Standards (AWQS) are not violated (Part V).

Dennis L. Turner
Dennis Turner
Supervisor, Water Permits Section, Mining Unit
Water Quality Division
Arizona Department of Environmental Quality
Signed this 17 day of April, 1997

Modified: 4-18-97

STATE OF ARIZONA

GROUNDWATER QUALITY PROTECTION PERMIT

Part I. AUTHORIZATION FOR FACILITY OPERATION SUCH THAT GROUNDWATER QUALITY OF THE STATE OF ARIZONA IS NOT ADVERSELY IMPACTED

In compliance with the provisions of A.R.S. 36-1851 et seq; A.A.C. Title 9, Chapter 20, Article 2; A.A.C. Title 9,Chapter 21, Article 2; and conditions set forth in this permit:

Facility Name:	Operator:
Hermit Mine	**International Uranium (USA) Corp.** **950 Independence Plaza** **1050 17th Street** **Denver, Colorado 80202**

is authorized to operate the Hermit Mine, an underground uranium mine located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W ½ SW ¼ - Gila and Salt River Base Line and Meridian.

This permit shall become effective on the date of signature and shall be valid for 15 years provided that the facility is operated and maintained in compliance with the specific conditions, general conditions, and information documented or referenced in Parts I, II, III, and IV of this Permit and such that **Aquifer Water Quality Standards (AWQS)** are not violated (Part V).

/s/
Brad L. Doores, Vice President
Legal and Regulatory Affairs
Energy Fuels Nuclear, Inc.

Signed this 8th day of
January, 1988

/s/
Ronald L. Miller, Ph.D., Assistant Director
Arizona Department of Environmental Quality

Signed this 29th day of
December, 1987

Modified: 4-18-97

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	0.025	1	206.2
Barium	0.5	2	208.1
Cadmium	0.005	1	213.2
Copper	0.5	2	220.1
Iron	0.15	2	236.1
Lead	0.025	1	239.2
Manganese	Reserved*	2	242.1
Mercury	0.001	1	245.1
* Nitrate (as N)	5.0	3	---
Selenium	0.005	1	270.2
Silver	0.025	2	272.1
Zinc	5.0	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	5.0	4,13	703
Gross Beta	5.0	4,13	703

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
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(1) Standard references are listed on Attachment I to this Permit.

These 2 pages were substituted on Oct. 12, 1988. Original

(Continued)

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	(micromhos per centimeter)		
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Radium 226	Reserved*	4,7	705,706

(1)Standard references are listed on Attachment I to this Permit.

* Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

23

Mining operation

STATE OF ARIZONA

GROUNDWATER QUALITY PROTECTION PERMIT

Part I. AUTHORIZATION FOR FACILITY OPERATION SUCH THAT GROUNDWATER QUALITY OF THE STATE OF ARIZONA IS NOT ADVERSELY IMPACTED.

In compliance with the provisions of A.R.S. 36-1851 et seq; A.A.C. Title 9, Chapter 20, Article 2; A.A.C. Title 9, Chapter 21, Article 2; and conditions set forth in this permit:

Facility Name:

Hermit Mine

Operator:

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202

(B-38-04)17
is authorized to operate the Hermit Mine, an underground uranium mine located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W 1/2 SW 1/4 - Gila and Salt River Base Line and Meridian.

This permit shall become effective on the date of signature and shall be valid for 15 years provided that the facility is operated and maintained in compliance with the specific conditions, general conditions, and information documented or referenced in Parts I, II, III and IV of this Permit and such that groundwater quality standards are not violated (Part V).

Brad L. Doores

Brad L. Doores, Vice President
Legal and Regulatory Affairs
Energy Fuels Nuclear, Inc.

Signed this 8th day of January 19 88

Ronald L. Miller

Ronald L. Miller, Ph.D., Assistant Director
Arizona Department of Environmental Quality

Signed this 29th day of December 19 87

Part II. SPECIFIC CONDITIONS (R9-20-208.C)

A. Disposal/Containment Requirements

1. Facility Water Containment

The facility shall be designed, constructed and maintained such that there will be no migration of wastes or pollutants either directly to groundwater or to the vadose zone.

a. The operator shall be restricted to the disposal of mine water and runoff from a 23-acre uranium mine site to a lined impoundment. All waters pumped from the underground and all runoff from the 23-acre mine operation's area shall be directed to the lined impoundment. The 12.6-acre-foot impoundment shall be lined with synthetic material equivalent to 36 mil Hypalon. The underlying surface shall contain no gravels greater than 1/4 inch. The operator shall maintain a minimum of 3-acre feet (2.4 feet) of freeboard in operating the impoundment. The operator shall maintain a reserve area for the construction of an additional lined impoundment following authorization for an increase in the mine yard disturbance area. The use of enhanced evaporation techniques shall be allowed as an alternative for controlling water level in the lined impoundment.

b. The ore storage pads shall be constructed of crushed and compacted limestone and/or shale not less than 12 inches in thickness. The ore storage pads shall be sloped toward the edges and a runoff collection structure shall be constructed to ensure that all runoff from the ore piles shall be directed to the lined impoundment.

c. The operator shall construct storm water diversion structures, as referenced in "Hydrologic Evaluations for the Proposed Hermit Uranium Mine", Dames & Moore, 1987, to control waters from no less than a 100-year, 24-hour precipitation event. The diversion structures shall be constructed from borrow material from within the operations area and shall be protected with heavy riprap. All construction shall be performed to prevent runoff from the mine operations area.

2. Sewage Disposal

The permittee is restricted to dispose the sewage generated from the travel trailers, office and host buildings into a septic tank and associated leach

lines. The septic tank, constructed in accordance with plans approved by the Mohave County Health Department, shall have a capacity of no less than 1,600 gallons and receive a maximum of 1,000 gallons per day of sewage.

3. Unauthorized Materials

   a. Materials authorized to be disposed of in the lined impoundment shall not include any materials that0 cause deterioration of the pond liner as indicated by the manufacturer's specifications for the liner material.

   b. Materials authorized to be disposed of in all septic tanks are typical household sewage and shall not include mine water, motor oil, gasoline, paints, varnishes, laboratory wastes, solvents, fertilizers, pesticides or other materials not generally associated with toilet flushing, food preparation, laundry and personal hygiene.

   c. Adequate supervision and operation shall be performed to ensure that all users of the facility are aware of and understand the containment/disposal requirements of Part II.A.1.

4. Discharge Source Limits

   Total domestic wastewater flow from the facility shall not exceed 1,000 gallons per day.

5. Mining Limit

   Total depth of the mine workings shall not exceed 1,500 feet below land surface.

6. Modification

   This permit is issued contingent upon the above conditions. The permittee shall give ninety (90) days written advance notice to the Department of any modification to the above facility.

7. Other Laws and Rules

   The operator must maintain compliance with all other State of Arizona laws and rules. The issuance of this permit does not waive any federal, state, county, or local government rules, regulations, or permits for which this facility may have to comply.

B. Monitoring Requirements, Record Keeping (R9-20-215)

1. Monitoring shall be conducted in three phases:

Phase I - Pre-Mining - Ambient Groundwater Characterization

Phase II - Mining - Evaluation of Possible Impacts

Phase III- Post-Mining - Evaluate the Effectiveness of Closure Activities.

a. Phase I - Pre-Mining

The purpose of Phase I monitoring is to determine baseline, the ambient groundwater characteristics. Ambient groundwater shall be defined as the arithmetic mean plus two standard deviations of the chemical concentrations for each parameter.

(1) The regional aquifer shall be sampled at the monitoring well, Department of Water Resources Well Registry No. 55-518877 as located at and constructed as described in Section 3.c. of the Notice of Disposal. The operator shall monitor this water supply/monitoring well quarterly for the parameters listed in Part II.B.2.b.

(2) Water producing zones shall be monitored in the shaft during shaft sinking. Water quality and quantity shall be taken from every geologic unit which produces water at the time of shaft penetration and quarterly thereafter until mining commences.

(3) Sixty (60) days after obtaining all of the Phase I water quality data as described above, the permittee shall submit a report to the Department's Water Permits Unit which summarizes the water quality data and establishes the Maximum Groundwater Limits for each sampling parameter. The Comprehensive List of Parameters listed in Part II.B.2.b. shall be utilized for this sampling report.

b. Phase II - Mining

The purpose of monitoring during the mining phase is to determine what impacts, if any, the operation is having on the groundwater quality.

(1) Discharge Monitoring

On an annual basis the effluent from the septic system shall be sampled and analyzed for those parameters listed in Part II.B.2.b. The sampling point shall be located after the effluent flows from the septic tank and before disposal to the leach trenches.

(2) Impoundment Monitoring

The operator shall inspect the impoundment for mechanical damage, seam failure and maintenance of freeboard on a daily basis.

(3) Groundwater Monitoring

The operator shall monitor the water supply/monitoring well, Department of Water Resources Well Registry No. 55-518877, quarterly for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Static water level in the well shall be measured and recorded prior to sample pumping. If the well is used for production, pumping shall be suspended for 24 hours prior to observing the static water level. The operator shall evacuate at least one bore volume prior to sampling the monitoring well. The amount pumped shall be recorded. The water purged from the well shall be contained in the lined impoundment, stored in impervious containers, or used at the mine site.

(4) Mine Inflow Monitoring

Mine inflows shall be monitored in the shaft and at the mine sump. Within the shaft, water quality and quantity shall be monitored annually from each geologic unit which continues to produce water for the parameters listed in Part II.B.2.b. Water quality analysis shall not be subject to Maximum Groundwater Limits.

Inflows within the mine shall be monitored at the mine sump for quality by quarterly sampling and analysis for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Quantity of mine inflows shall be estimated on a quarterly basis taking into account the

consumption of water by underground drilling and dust control, and the return flows from these operations. Any significant inflows shall be depicted on a mine map and submitted to ADEQ as part of the quarterly report.

c. Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

The operator shall continue to monitor the water sampling/monitoring well, Division of Water Resources Well Registry No. 55-51877 semiannually during a minimum period of fifteen (15) years for the parameters in Part II.B.2.b. The Maximum Groundwater Limits shall be those calculated for Phase II (mining) groundwater monitoring.

2. Constituents for Analyses

Two categories of constituents for analysis shall be used while monitoring - indicator parameters with Alert Levels and comprehensive list of parameters with Maximum Groundwater Limits:

a. Indicator Parameters

If laboratory chemical analyses for a water sample would detect concentrations of gross alpha, gross beta, and/or any of the selected trace elements in excess of the alert levels, the source for the water sample would be resampled and analyzed for the comprehensive list of parameters:

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	Reserved*	1	206.2
Barium	Reserved*	2	208.1
Cadmium	Reserved*	1	213.2
Copper	Reserved*	2	220.1
Iron	Reserved*	2	236.1
Lead	Reserved*	1	239.2
Manganese	Reserved*	2	242.1
Mercury	Reserved*	1	245.1
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Silver	Reserved*	2	272.1
Zinc	Reserved*	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	Reserved*	4,13	703
Gross Beta	Reserved*	4,13	703

(1)Standard references are listed on Attachment I to this Permit.

* Reserved - Alert levels shall be established once Phase I - Premining Ambient Groundwater Characterization, has been completed and evaluated by the Department.

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved**	4	403
Arsenic	Reserved**	1	206.2
Barium	Reserved**	2	208.1
Bicarbonate	Reserved**	3	305.1
Cadmium	Reserved**	1	213.2
Calcium	Reserved**	2	215.1
Carbonate	Reserved**	4	403

(Cont'd.)

PARAMETER	MAXIMUM GROUNDWATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Chloride	Reserved**	3	325.3
Chromium (total)	Reserved**	1	218.2
Copper	Reserved**	2	220.1
Fluoride	Reserved**	3	340.2
Iron	Reserved**	2	236.1
Lead	Reserved**	1	239.2
Magnesium	Reserved**	2	243.1
Manganese	Reserved**	2	243.1
Mercury	Reserved**	1	245.1
Nitrate (as N)	Reserved**	3	---
Phosphate	Reserved**	4	424
Potassium	Reserved**	2	258.1
Selenium	Reserved**	1	270.2
Silver	Reserved**	2	272.1
Silica	Reserved**	-	---
Sodium	Reserved**	2	273.1
Sulfate	Reserved**	3	375.3
Total Dissolved Solids	Reserved**	3	160.3
Zinc	Reserved**	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved**	3	120.1
	(picocuries per liter)		
Gross Alpha	Reserved**	4,13	703
Gross Beta	Reserved**	4,13	703
Total Uranium	Reserved**	9,10	---
Thorium 230	Reserved**	9,10	---
Radium 226	Reserved**	4,7	705,706

(1) Standard references are listed on Attachment I to this Permit.

** Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

(1) If a primary or secondary drinking water standard or Maximum Groundwater Limit has been established for a parameter by Arizona State regulatory agencies, and if the arithmetic mean plus two standard deviations of concentrations of the parameter in groundwater samples obtained during the pre-mining period does not exceed the drinking water standard, the Maximum Groundwater Limit shall be the drinking water standard.

If the arithmetic mean plus two standard deviations of concentrations of the parameter exceeds an established primary or secondary drinking water standard, the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of concentration of the parameter in groundwater samples.

(2) If a primary or secondary drinking water standard has not been established by the regulatory agencies for a parameter and the parameter is detected in groundwater samples during the pre-mining period, or if the arithmetic mean plus two standard deviations of concentrations in groundwater samples obtained during the pre-mining period exceeds the established drinking water standard, then the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of the pre-mining concentrations.

(3) If a parameter is not detected during the pre-mining monitoring period, and a primary or secondary drinking water standard has not been established for the parameter, the Maximum Groundwater Limit shall be twice the detection limit for the EPA laboratory method used.

3. Monitoring Forms

All monitoring results shall be recorded and reported on the Self-Monitoring Form supplied by ADEQ. This form should be given to the laboratory performing the analysis.

4. Reporting

The permittee shall submit a report summarizing progress of the mine development and monitoring results on an annual basis. The report shall contain a current site plan, a map of the underground mine workings including elevations, and shall indicate the locations of all monitoring sites required by this permit. All analytical monitoring results for the previous quarter shall be postmarked no later than

the 28th day of the second month following the completed reporting period as indicated below:

Self-Monitoring Report Forms for	are due by
1st Quarter (Jan, Feb, Mar)	May 28
2nd Quarter (Apr, May, Jun)	Aug 28
3rd Quarter (Jul, Aug, Sep)	Nov 28
4th Quarter (Oct, Nov, Dec)	Feb 28

All laboratory reports shall be submitted to the following location:

Arizona Department of Environmental Quality
OWQ - Water Pollution/UST Compliance Unit
2005 North Central Avenue
Phoenix, Arizona 85004

C. Contingency Requirements

1. Should any of the monitoring results required by this permit exceed the alert level specified for a particular parameter, the permittee shall immediately notify the Department of the apparent exceedance and resample to determine the validity of the sample result.

2. In the event that a confirmed exceedance of the Maximum Groundwater Limit specified in Part II.B.2.b. occurs at the monitoring well, the operator shall submit a report within 60 days which assesses the impacts from the exceedance and the mining operation.

3. In the event that the minimum freeboard requirement specified in Part II.A.1.a. is violated, the permittee shall construct an additional impoundment equivalent in construction to the lined impoundment required by Part II.A.1.a.

4. In the event that any portion of the containment system or the septic system fails, resulting in the violation of permit conditions, the owner/operator shall notify the Department's Water Pollution/UST Compliance Unit and the Mohave County Health Department immediately to determine the appropriate action to mitigate the effects of the violation.

D. Closure/Post Closure

1. The Department shall be notified in writing at least one hundred and eighty (180) days prior to closure or abandonment of the facility. The operator shall submit and have approved an updated Post-closure Plan prior to this time.

2. Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of a clay plug, a 40% clay/60% crushed shale plug or a bentonite plug in the main shaft, the air shaft and the monitoring well.

   The operator shall submit construction plans, specifications and techniques for the installation of the plugs, for the Department's approval, sixty (60) days prior to their installation.

3. Following the expiration date of this permit, the permittee shall continue monitoring listed in Part II.B.1.c. on a quarterly basis. In the event that a Maximum Groundwater Limit as described in Part II.B.2.b. is confirmed to be exceeded, the permittee shall immediately notify the Department and, within 30 days of such a violation, submit a plan to mitigate the effects of the violation.

4. In the event of abandonment, the septic tank shall have the sewage removed therefrom and be completely filled with earth, sand, gravel, or concrete. The top cover over the septic tank shall be removed before filling and the filling shall extend to the level of the top of the ground.

E. Compliance Schedule (R-20-219)

1. Within 60 days of the completion of the main shaft sinking, the operator shall submit an analysis showing that the collection sumps are impermeable and the sumps do not leak or the operator shall provide a plan for containment.

2. The operator shall notify the Water Pollution/UST Compliance Unit no less than 7 days prior to the installation of the liner specified in Part II.A.1.

Part III. REFERENCES: PERTINENT INFORMATION

A. References

The terms and conditions set forth in this permit have been developed based upon the information contained in the following:

1. Groundwater Field Inspection Form(s) dated _____

2. Notice of Disposal dated June 14, 1987

3. Groundwater Impact Review dated August 4, 1987

4. Plan Review File Number _____

5. Permit Application dated _____

6. Groundwater Impact Review dated _____

7. Amendments to 2 and 4 dated _____

8. Public Notice dated September 14, 1987

9. Public Hearing comments, correspondence letters, and any additional supplemental information contained in the facility permit file.

10. Other _____

B. Facility Information

1. Facility contact person **Michelle R. Rehmann, Env. Mgr.**

2. Address **950 Independence Plaza**
1050 17th Street
Denver, CO 80202

3. Emergency Telephone Number: Business **(303) 628-7798**
Home _____

The Department shall be notified within 30 days of a change in the facility contact person.

4. Landowner of Facility Site B.L.M.

Part III. REFERENCES: PERTINENT INFORMATION

A. References

The terms and conditions set forth in this permit have been developed based upon the information contained in the following:

1. Groundwater Field Inspection Form(s) dated _____

2. Notice of Disposal dated June 14, 1987

3. Groundwater Impact Review dated August 4, 1987

4. Plan Review File Number _____

5. Permit Application dated _____

6. Groundwater Impact Review dated _____

7. Amendments to 2 and 4 dated _____

8. Public Notice dated September 14, 1987

9. Public Hearing comments, correspondence letters, and any additional supplemental information contained in the facility permit file.

10. Other _____

B. Facility Information

1. Facility Contact Person Roger Smith

2. Address Energy Fuel Nuclear, Inc.
P. O. Box 36
Fredonia, AZ 86022

3. Emergency Telephone Number: Business (602) 643-7321
Home ( )

The Department shall be notified within 30 days of a change in the facility contact person.

4. Landowner of Facility Site B. L. M.

RIMS DB - VOLUME LOG

Hermit Mine Clean Closure Inventory #100299

International Uranium (USA) Corporation

VOLUME NUMBER	CONTENTS	LOC-ATION
001	Administrative Folder, Correspondence, dated 12/1987 to 01/1989	
002	Correspondence, dated 07/1990 to 01/1999	
003	Report - The Hermit Project Draft Environmental Assessment: 04/07/1987 Report - Hermit Mine - Groundwater Conditions: 03/20/1987 Report - Hermit Mine - Hydrologic Evaluations: 02/1987 Report - Pinenut Mine - Groundwater Protection Permit G-0036-08: 02/1990 Report - Hermit Mine - Review of Shaft & Raise Closure Plan: 02/1990 Report - Hermit Mine - (Barringer Laboratories): 05/03/91 Report - Hermit Mine - (Barringer Laboratories): 05/03/91 Report - Hermit Mine - Water Quality Data Evaluation: 06/1991 Report - Hermit Mine - Water Quality Data Evaluation: 06/1991 Report - Hermit Mine - Clean Closure Report:12/18/1998 Report - Hermit Mine - Clean Closure Report:12/18/1998 Report - Hermit Mine - Clean Closure - Additional Information Requests: 01/29/1999	

File Inventory - Hermit Mine Clean Closure **Inventory #100299**
International Uranium (USA) Corporation

Volume #	Contents
001	Permit folder, Correspondence, dated 12/1987 to 01/1989
002	Correspondence, dated 07/1990 to 01/1999
003	Report - The Hermit Project Draft Environmental Assessment: 04/07/1987 Report - Hermit Mine - Groundwater Conditions: 03/20/1987 Report - Hermit Mine - Hydrologic Evaluations: 02/1987 Report - Pinenut Mine - Groundwater Protection Permit G-0036-08: 02/1990 Report - Hermit Mine - Review of Shaft & Raise Closure Plan: 02/1990 Report - Hermit Mine - (Barringer Laboratories): 05/03/91 Report - Hermit Mine - (Barringer Laboratories): 05/03/91 Report - Hermit Mine - Water Quality Data Evaluation: 06/1991 Report - Hermit Mine - Water Quality Data Evaluation: 06/1991 Report - Hermit Mine - Clean Closure Report:12/18/1998 Report - Hermit Mine - Clean Closure Report:12/18/1998 Report - Hermit Mine - Clean Closure - Additional Information Requests: 01/29/1999

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

ROUTE SLIP

TO	DATE	INITIAL
1. Miguel Santiago	12/9/87	
2. Gary Ullinskey	12/17/87	
3. Skip Hellerud	12/22/87	
4. Lyndon Hammon		
5. Ron Miller		
6.		

☐ Action ☐ Comments
☐ Circulate ☐ Information
☒ Signature ☐ See Me
☐ Note & Return ☐ Prepare Reply
☐ Investigate ☐ See Remarks

REMARKS:

Final Groundwater Quality Protection Permit
Hermit Mine No. G-0035-08

FROM	Date
Gerri Plain	12/9/87
	Phone 257-2270

ADEQ/ADM/OSS-105(4/87)

AR[redacted] DEPARTMENT OF ENVIRONMENTAL [redacted]LITY

Inter-Office Memorandum

TO: Ronald L. Miller, Ph.D., Assistant Director
Office of Water Quality

FROM: Lyndon R. Hammon, Section Manager
Plan Review and Permits Section

RE: Hermit Mine
Final Groundwater Quality Protection Permit No. G-0035-08

Attached for your signature is a final and official Groundwater Quality Protection Permit (GWQPP) for the above referenced facility. The facility, located approximately 21 miles south of Fredonia, Arizona, in Mohave County will consist of mine workings to a depth of approximately 1500-feet and a 23 acre surface operations area. The facility will be constructed as a zero discharge facility except for a septic system for disposal of typical domestic wastes. All waters pumped from the underground and all runoff from the surface facility shall be directed to a lined surface impoundment and storm water will be diverted around the facility. All water containment and diversion structures shall be designed, constructed and maintained to control waters from no less than a 100-year, 24-hour precipitation event.

This GWQPP has received the required 30-day internal and external review, and a 30-day Public Notice period has expired.

Attached are copies of the Affidavit of Publication, the Public Notice and Responsiveness Summary for the comments received during the external/internal review.

If you have any questions concerning this permit, please contact Miguel Santiago 257-6806.

LRH:lb

Attachments

A[redacted] DEPARTMENT OF ENVIRONMENT[redacted]ALITY

Inter-Office Memorandum

December 08, 1987

TO: File

FROM: Miguel A. Santiago
Water Permits Unit

RE: Hermit Mine
Groundwater Quality Protection Permit No. G-0035-08
Responsiveness Summary

Michael Leach, State Permits Hydrology Unit

COMMENTS

COMMENT 1. Upon obtaining all Phase I (pre-mining) water quality data as described in Part II.B.1.a. of the draft permit, a report which summarizes the water quality data and establishes the Maximum Groundwater Limit (MGL) for each sampling parameter should be submitted to ADEQ. MGL's should be assigned using the procedure described in Part II.B.2.b of the draft permit.

RESPONSE 1: Item (3) is added to part II.B.1.a. to read:

(3) Sixty (60) days after obtaining all of the Phase I water quality data as described above, the permittee shall submit a report to the Department's Water Permits Unit which summarizes the water quality data and establishes the Maximum Groundwater Limits for each sampling parameter. The Comprehensive List of Parameters listed in Part II.B.2.b. shall be utilized for this sampling report.

COMMENT 2: The proposed Phase III (post mining) groundwater sampling frequency and subsequent data manipulation used to determine the eventual cessation of sampling activities (described in Part II.B.1.c.2. of the draft permit) should be changed. The problem is that the draft permit does not take into consideration the potential length of time necessary from any contaminated water from the mine shaft to travel several hundred feet to the regional water table. If the vadose zone is not substantially fractured, travel time could take several years, depending on the verticle permeability of the vadose zone rock formations. Therefore, a long term, post-closure sampling program should be implemented. The sampling program should last 15 years with semiannual sampling of the on-site water supply/monitor well. Water quality analyses should include the parameters listed in part II.B.2.b. of the draft permit, and the MGL's should remain the same as calculated for Phase II (mining) groundwater monitoring.

RESPONSE 2: Phase III-Post-Mining of the draft permit is modified to read:

> The operator shall continue to monitor the water sampling /monitoring well, Division of Water Resourses Well Registry No. 55-511877 semiannually during a minimum period of fifteen years for the parameters in Part II.B.2.b. The Maximum Groundwater Limits shall be those calculated for phase II (mining) groundwater monitoring.

Jerry Breckenridge-Northern Regional Office

COMMENT 1: Possible necessity for overflow structure to prevent breaching of dike.

RESPONSE 1: The lined impoundment shall be constructed in a similar way as Canyon Mine's impoundment facility, referenced in Exhibit A of the Canyon Mine permit application. The 12.6 acre-foot impoundment shall be lined with synthetic material equivalent to 36 mil Hypalon. A minimum freeboard of 2.4 feet shall be maintained as well as a reserved area for the contruction of additional impoundment if necessary. Part II.E. 2. (Compliance Schedules) requires that the operator notify the Department no less than 7 days prior to the installation of the liner for the purpose of inspection and to verify adherence to the permit requirements

COMMENT 2: Possible necessity for underdrain leachate recovery system for the ore storage pad.

RESPONSE 2: The permit requires that the ore storage pad shall be sloped toward the edges and a runoff collection structure shall be constructed to ensure that all runoff from the piles shall be directed to the lined impoundment.

COMMENT 3: Submit exact sampling points for reference and months of activity.

RESPONSE 3: Part B.4. of the permit requires that the annual report of monitoring activities indicate the location of all monitoring of sites required by this permit. Part B.I.a. (2) shall be modified to include that discrete samples shall be taken for monitoring in the water producing units in the shaft.

COMMENT 4: Thickness, construction techniques, certification of construction of plug.

RESPONSE 4: The following is added to item 2 of Part II.D regarding the plug:

> The operator shall submit constructions plans, specifications and techniques for the installation of the plugs, for the Department's approval, sixty (60) days prior

to their installation.

COMMENT 5: Proper abandonment of septic tank as per uniform plumbing code.

RESPONSE 5:

Part II.D.4. regarding abandonment of septic tank is modified to read:

> In the event of abandonment, the septic tank shall have the sewage removed therefrom and be completely filled with earth, sand, gravel, or concrete. The top cover over the septic tank shall be removed before filling and the filling shall extend to the level of the top of the ground.

Part II.A.2. Sewage disposal is modified to read:

> The permittee is restricted to dispose the sewage generated from the travel trailers, office and host buildings into a septic tank and associated leach lines. The septic tank, constructed in accordance with the plans approved by the Mohave County Health Department, shall have a capacity of no less than 1,600 gallons and receive a maximum of 1,000 gallons per day of sewage.

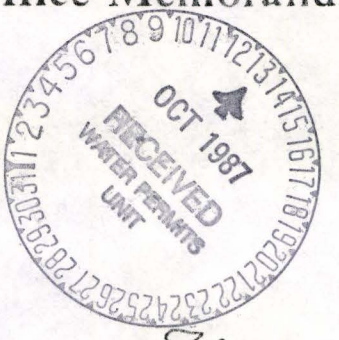
The following is added to Part II.b.1.b. (1) Discharge Monitoring:

> The sampling point shall be located after the effluent flows from the septic tank and before disposal to the leach trenches.

MAS:lb

[redacted]NA DEPARTMENT OF ENVIRONME[redacted]UALITY

Inter-Office Memorandum



9/30/87



TO: See Distribution

THRU: Roger Kennett, Program Supervisor
Existing Groundwater Facilities Team

FROM: Carol Russell CR
Existing Groundwater Facilities Team
Jerry Breckenridge NRO

RE: Hermit Mine
Draft Groundwater Quality Protection Permit No. G-0035-08

Attached for your review and comment is the draft permit for the referenced facility. The applicant, Energy Fuels Nuclear, Inc., has proposed to operate Hermit Mine located approximately 21 miles south of Fredonia, Arizona, in Mohave County. The facility will consist of mine workings to a depth of approximately 1500-feet and a 23-acre surface operations area. The facility will be constructed as a zero discharge facility except for a septic system for disposal of typical domestic wastes. All waters pumped from the underground and all runoff from the surface facility shall be directed to a lined surface impoundment and storm water will be diverted around the facility. All water containment and diversion structures shall be designed, constructed and maintained to control waters from no less than a 100-year, 24-hour precipitation event.

Please return any comments and objections you may have concerning this permit to the Water Permits Unit within thirty (30) days of the date of this memo. If you have any questions concerning this permit, please contact me at 257-6806.

CR:mm

Attachment

Distribution:
Skip Hellerud, Manager, Water Permits Unit
Lyndon Hammon, Manager, Plan Review and Permits Section
Sally L. Mapes, Manager, Compliance Section
Jack Bale, Water Assessment Section
Phil King, Manager, Emergency Response & Remedial Projects Section
Norm Weiss, Manager, Office of Planning & Program Development
Bill Wiley, Manager, Hydrology Section
Harley Hiett, Manager, Northern Regional Office
Technical Review Unit
Jerry Breckenridge

SEP 30 1987
DRAFT FOR REVIEW AND DISCUSSION

STATE OF ARIZONA

GROUNDWATER QUALITY PROTECTION PERMIT

Part I. AUTHORIZATION FOR FACILITY OPERATION SUCH THAT GROUNDWATER QUALITY OF THE STATE OF ARIZONA IS NOT ADVERSELY IMPACTED.

In compliance with the provisions of A.R.S. 36-1851 et seq; A.A.C. Title 9, Chapter 20, Article 2; A.A.C. Title 9, Chapter 21, Article 2; and conditions set forth in this permit:

Facility Name:	Operator:
Hermit Mine	Energy Fuels Nuclear, Inc. One Tabor Center, Suite 2500 1200 Seventeenth Street Denver, Colorado 80202

is authorized to operate the Hermit Mine, an underground uranium mine located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W 1/2 SW 1/4 - Gila and Salt River Base Line and Meridian.

This permit shall become effective on the date of signature and shall be valid for 15 years provided that the facility is operated and maintained in compliance with the specific conditions, general conditions, and information documented or referenced in Parts I, II, III and IV of this Permit and such that groundwater quality standards are not violated (Part V).

Brad L. Doores, Vice President
Legal and Regulatory Affairs
Energy Fuels Nuclear, Inc.

Signed this ____ day of

_____ 19 ___

Gerald Teletzke, Ph.D., Director
Arizona Department of Environmental Health

Signed this ____ day of

_____ 19 ___

SEP 3 0 1987

[redacted] DRAFT FOR REVIEW AND DISCUSSION

Part II. SPECIFIC CONDITIONS (R9-20-208.C)

A. Disposal/Containment Requirements

1. Facility Water Containment

The facility shall be designed, constructed and maintained such that there will be no migration of wastes or pollutants either directly to groundwater or to the vadose zone.

Possible NECESSITY FOR OVERFLOW STRUCTURE DESIGN APPROVAL

a. The operator shall be restricted to the disposal of mine water and runoff from a 23-acre uranium mine site to a lined impoundment. All waters pumped from the underground and all runoff from the 23-acre mine operation's area shall be directed to the lined impoundment. The 12.6-acre-foot impoundment shall be lined with synthetic material equivalent to 36 mil Hypalon. The underlying surface shall contain no gravels greater than 1/4 inch. The operator shall maintain a minimum of 3-acre feet (2.4 feet) of freeboard in operating the impoundment. The operator shall maintain a reserve area for the construction of an additional lined impoundment following authorization for an increase in the mine yard disturbance area. The use of enhanced evaporation techniques shall be allowed as an alternative for controlling water level in the lined impoundment.

Possible NECESSITY FOR under DRAIN leachate recovery system

b. The ore storage pads shall be constructed of crushed and compacted limestone and/or shale not less than 12 inches in thickness. The ore storage pads shall be sloped toward the edges and a runoff collection structure shall be constructed to ensure that all runoff from the ore piles shall be directed to the lined impoundment.

c. The operator shall construct storm water diversion structures, as referenced in "Hydrologic Evaluations for the Proposed Hermit Uranium Mine", Dames & Moore, 1987, to control waters from no less than a 100-year, 24-hour precipitation event. The diversion structures shall be constructed from borrow material from within the operations area and shall be protected with heavy riprap. All construction shall be performed to prevent runoff from the mine operations area.

FOR WHAT ??

Office BLDG CAMP SITE ?

2. Sewage Disposal

The operator shall construct a septic system with a design capacity of 1,000 gallons per day. The septic system shall be constructed in accordance with plans

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[redacted]
DRAFT FOR REVIEW AND DISCUSSION

approved by the Mohave County Health Department. The septic system shall consist of a septic tank no less than 1,600 gallons and associated leach lines.

3. Unauthorized Materials

a. Materials authorized to be disposed of in the lined impoundment shall not include any materials that cause deterioration of the pond liner as indicated by the manufacturer's specifications for the liner material.

b. Materials authorized to be disposed of in all septic tanks are typical household sewage and shall not include mine water, motor oil, gasoline, paints, varnishes, laboratory wastes, solvents, fertilizers, pesticides or other materials not generally associated with toilet flushing, food preparation, laundry and personal hygiene.

c. Adequate supervision and operation shall be performed to ensure that all users of the facility are aware of and understand the containment/disposal requirements of Part II.A.1.

4. Discharge Source Limits

Total domestic wastewater flow from the facility shall not exceed 1,000 gallons per day.

5. Mining Limit

Total depth of the mine workings shall not exceed 1,500 feet below land surface.

6. Modification

This permit is issued contingent upon the above conditions. The permittee shall give ninety (90) days written advance notice to the Department of any modification to the above facility.

B. Monitoring Requirements, Record Keeping (R9-20-215)

1. Monitoring shall be conducted in three phases:

Phase I - Pre-Mining - Ambient Groundwater Characterization

Phase II - Mining - Evaluation of Possible Impacts

Phase III- Post-Mining - Evaluate the Effectiveness of Closure Activities.

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[redacted] DRAFT FOR REVIEW AND DISCUSSION

a. Phase I - Pre-Mining

The purpose of Phase I monitoring is to determine baseline, the ambient groundwater characteristics. Ambient groundwater shall be defined as the arithmetic mean plus two standard deviations of the chemical concentrations for each parameter.

Well ADWR 55-518877 completed 1/12/1988

(1) The regional aquifer shall be sampled at the monitoring well, Department of Water Resources Well Registry No. as located at and constructed as described in Section 7.c. of the Notice of Disposal. The operator shall monitor this water supply/monitoring well quarterly for the parameters listed in Part II.B.2.b.

(2) Water producing zones shall be monitored in the shaft during shaft sinking. Water quality and quantity shall be taken from every geologic unit which produces water at the time of shaft penetration and quarterly thereafter until mining commences.

b. Phase II - Mining

The purpose of monitoring during the mining phase is to determine what impacts, if any, the operation is having on the groundwater quality.

(1) Discharge Monitoring

On an annual basis the effluent from the septic system shall be sampled and analyzed for those parameters listed in Part II.B.2.b.

(2) Impoundment Monitoring

The operator shall inspect the impoundment for mechanical damage, seam failure and maintenance of freeboard on a daily basis.

(3) Groundwater Monitoring

The operator shall monitor the water supply/monitoring well, Department of Water Resources Well Registry No. , quarterly for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Static water level in the well shall be measured and recorded prior to sample pumping. If the well is

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[redacted]

DRAFT FOR REVIEW AND DISCUSSION

used for production, pumping shall be suspended for 24 hours prior to observing the static water level. The operator shall evacuate at least one bore volume prior to sampling the monitoring well. The amount pumped shall be recorded. The water purged from the well shall be contained in the lined impoundment, stored in impervious containers, or used at the mine site.

(4) Mine Inflow Monitoring

Might need a sampling pt. structure for collection of representative samples.

Mine inflows shall be monitored in the shaft and at the mine sump. Within the shaft, water quality and quantity shall be monitored annually from each geologic unit which continues to produce water for the parameters listed in Part II.B.2.b. Water quality analysis shall not be subject to Maximum Groundwater Limits.

Inflows within the mine shall be monitored at the mine sump for quality by quarterly sampling and analysis for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Quantity of mine inflows shall be estimated on a quarterly basis taking into account the consumption of water by underground drilling and dust control, and the return flows from these operations. Any significant inflows shall be depicted on a mine map and submitted to ADEQ as part of the quarterly report.

c. Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

(1) The operator shall monitor the water supply/monitoring well, Division of Water Resources Well Registry No. , quarterly for the parameters in Part II.B.2.b.

(2) The sampling can be discontinued when the sampling location is no longer accessible or when the average concentrations of all parameters are less than or equal to the Maximum Groundwater Limit plus two standard deviations. The arithmetic average shall be calculated based on a five-point running

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DRAFT FOR REVIEW AND DISCUSSION

average, the latest concentration and the four previous concentrations after closure.

Any individual concentrations that exceed the pre-mining mean concentration plus four standard deviations shall be rejected as anomalous and not used for calculation of the five-point running averages unless two samples in a row exceed the mean concentration.

2. Constituents for Analyses

Two categories of constituents for analysis shall be used while monitoring - indicator parameters with Alert Levels and comprehensive list of parameters with Maximum Groundwater Limits:

a. Indicator Parameters

If laboratory chemical analyses for a water sample would detect concentrations of gross alpha, gross beta, and/or any of the selected trace elements in excess of the alert levels, the source for the water sample would be resampled and analyzed for the comprehensive list of parameters:

SEP 3 0 1987 [redacted]
DRAFT FOR REVIEW AND DISCUSSION

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	0.025	1	206.2
Barium	0.5	2	208.1
Cadmium	0.005	1	213.2
Copper	0.5	2	220.1
Iron	0.15	2	236.1
Lead	0.025	1	239.2
Manganese	Reserved*	2	242.1
Mercury	0.001	1	245.1
Nitrate (as N)	5.0	3	---
Selenium	0.005	1	270.2
Silver	0.025	2	272.1
Zinc	5.0	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	5.0	4,13	703
Gross Beta	5.0	4,13	703

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved*	4	403
Arsenic	0.05	1	206.2
Barium	1.0	2	208.1
Bicarbonate	Reserved*	3	305.1
Cadmium	0.010	1	213.2
Calcium	Reserved*	2	215.1
Carbonate	Reserved*	4	403
Chloride	Reserved*	3	325.3
Chromium (total)	0.05	1	218.2
Copper	1.0	2	220.1

(1) Standard references are listed on Attachment I to this Permit.

SEP 3 0 19[redacted]
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(Cont'd.)

PARAMETER	MAXIMUM GROUNDWATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Fluoride	2.4	3	340.2
Iron	0.3	2	236.1
Lead	0.05	1	239.2
Magnesium	Reserved*	2	243.1
Manganese	Reserved*	2	243.1
Mercury	0.002	1	245.1
Nitrate (as N)	10.0	3	---
Phosphate	Reserved*	4	424
Potassium	Reserved*	2	258.1
Selenium	0.01	1	270.2
Silver	0.05	2	272.1
Silica	Reserved*	-	---
Sodium	Reserved*	2	273.1
Sulfate	Reserved*	3	375.3
Total Dissolved Solids	Reserved*	3	160.3
Zinc	Reserved*	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved*	3	120.1
	(picocuries per liter)		
Gross Alpha	15	4,13	703
Gross Beta	50	4,13	703
Total Uranium	Reserved*	9,10	---
Thorium 230	Reserved*	9,10	---
Radium 226	Reserved*	4,7	705,706

(1)Standard references are listed on Attachment I to this Permit.

* Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

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[redacted]
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(1) If a primary or secondary drinking water standard or Maximum Groundwater Limit has been established for a parameter by Arizona State regulatory agencies, and if the arithmetic mean plus two standard deviations of concentrations of the parameter in groundwater samples obtained during the pre-mining period does not exceed the drinking water standard, the Maximum Groundwater Limit shall be the drinking water standard.

Formula to be used in Calcs. may be helpful

If the arithmetic mean plus two standard deviations of concentrations of the parameter exceeds an established primary or secondary drinking water standard, the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of concentration of the parameter in groundwater samples.

(2) If a primary or secondary drinking water standard has not been established by the regulatory agencies for a parameter and the parameter is detected in groundwater samples during the pre-mining period, or if the arithmetic mean plus two standard deviations of concentrations in groundwater samples obtained during the pre-mining period exceeds the established drinking water standard, then the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of the pre-mining concentrations.

(3) If a parameter is not detected during the pre-mining monitoring period, and a primary or secondary drinking water standard has not been established for the parameter, the Maximum Groundwater Limit shall be twice the detection limit for the EPA laboratory method used.

3. Monitoring Forms

All monitoring results shall be recorded and reported on the Self-Monitoring Form supplied by ADEQ. This form should be given to the laboratory performing the analysis.

4. Reporting

The permittee shall submit a report summarizing progress of the mine development and monitoring results on an annual basis. The report shall contain a current site plan, a map of the underground mine workings including elevations, and shall indicate the locations of all monitoring sites required by this permit. All analytical monitoring results for the previous quarter shall be postmarked no later than

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[redacted]

DRAFT FOR REVIEW AND DISCUSSION

the 28th day of the second month following the completed reporting period as indicated below:

Self-Monitoring Report Forms for	are due by
1st Quarter (Jan, Feb, Mar)	May 28
2nd Quarter (Apr, May, Jun)	Aug 28
3rd Quarter (Jul, Aug, Sep)	Nov 28
4th Quarter (Oct, Nov, Dec)	Feb 28

All laboratory reports shall be submitted to the following location:

Arizona Department of Environmental Quality
OWWQM - Water Pollution/UST Compliance Unit
2005 North Central Avenue
Phoenix, Arizona 85004

C. Contingency Requirements

A single sample or 2 of 3 resamples

1. Should any of the monitoring results required by this permit exceed the alert level specified for a particular parameter, the permittee shall immediately notify the Department of the apparent exceedance and resample to determine the validity of the sample result.

2. In the event that a confirmed exceedance of the Maximum Groundwater Limit specified in Part II.B.2.b. occurs at the monitoring well, the operator shall submit a report within 60 days which assesses the impacts from the exceedance and the mining operation.

3. In the event that the minimum freeboard requirement specified in Part II.A.1.a. is violated, the permittee shall construct an additional impoundment equivalent in construction to the lined impoundment required by Part II.A.1.a.

4. In the event that any portion of the containment system or the septic system fails, resulting in the violation of permit conditions, the owner/operator shall notify the Department's Water Pollution/UST Compliance Unit and the Mohave County Health Department immediately to determine the appropriate action to mitigate the effects of the violation.

D. Closure/Post Closure

1. The Department shall be notified in writing at least one hundred and eighty (180) days prior to closure or abandonment of the facility. The operator shall submit and have approved an updated Post-closure Plan prior to this time.

SEP 30 1987 [redacted] DRAFT FOR REVIEW AND DISCUSSION

2. Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of clay, shale or bentonite plugs in both the main shaft, the air shaft and the monitoring well.

Permeability Thickness? depth? construction technique? certification? adequacy? cost?

3. Following the expiration date of this permit, the permittee shall continue monitoring listed in Part II.B.1.c. on a quarterly basis. In the event that a Maximum Groundwater Limit as described in Part II.B.2.b. is confirmed to be exceeded, the permittee shall immediately notify the Department and, within 30 days of such a violation, submit a plan to mitigate the effects of the violation.

4. In the event that the septic system is abandoned for any reason, any remaining septage shall be disposed of off-site at a location approved to accept such wastes. AND Septic presently ABANDONED U.P.C.

E. Compliance Schedule (R-20-219)

1. Within 60 days of the completion of the main shaft sinking, the operator shall submit an analysis showing that the collection sumps are impermeable and the sumps do not leak or the operator shall provide a plan for containment.

2. The operator shall notify the Water Pollution/UST Compliance Unit no less than 7 days prior to the installation of the liner specified in Part II.A.1.

BMP's Should be developed to HANDLE

1.) Discharge Containment,
2) Equipment failure
3) Notification Procedures / In House and Regulatory.
4) MAINTENANCE Procedures

ETC.

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Part III. REFERENCES: PERTINENT INFORMATION

A. References

The terms and conditions set forth in this permit have been developed based upon the information contained in the following:

1. Groundwater Field Inspection Form(s) dated _____

2. Notice of Disposal dated June 14, 1987

3. Groundwater Impact Review dated August 4, 1987

4. Plan Review File Number _____

5. Permit Application dated _____

6. Groundwater Impact Review dated _____

7. Amendments to 2 and 4 dated _____

8. Public Notice dated September 14, 1987

9. Public Hearing comments, correspondence letters, and any additional supplemental information contained in the facility permit file.

10. Other _____

B. Facility Information

1. Facility Contact Person _____

2. Address _____

3. Emergency Telephone Number: Business ( )

Home ( )

The Department shall be notified within 30 days of a change in the facility contact person.

4. Landowner of Facility Site B. L. M.

ARIZ DEPARTMENT OF ENVIRONMENTAL QUALITY

Inter-Office Memorandum

9/30/87

TO: See Distribution

THRU: Roger Kennett, Program Supervisor RK
Existing Groundwater Facilities Team

FROM: Carol Russell CR
Existing Groundwater Facilities Team

RE: Hermit Mine
Draft Groundwater Quality Protection Permit No. G-0035-08

Attached for your review and comment is the draft permit for the referenced facility. The applicant, Energy Fuels Nuclear, Inc., has proposed to operate Hermit Mine located approximately 21 miles south of Fredonia, Arizona, in Mohave County. The facility will consist of mine workings to a depth of approximately 1500-feet and a 23-acre surface operations area. The facility will be constructed as a zero discharge facility except for a septic system for disposal of typical domestic wastes. All waters pumped from the underground and all runoff from the surface facility shall be directed to a lined surface impoundment and storm water will be diverted around the facility. All water containment and diversion structures shall be designed, constructed and maintained to control waters from no less than a 100-year, 24-hour precipitation event.

Please return any comments and objections you may have concerning this permit to the Water Permits Unit within thirty (30) days of the date of this memo. If you have any questions concerning this permit, please contact me at 257-6806.

CR:mm

Attachment

Distribution:
Skip Hellerud, Manager, Water Permits Unit
Lyndon Hammon, Manager, Plan Review and Permits Section
Sally L. Mapes, Manager, Compliance Section
Jack Bale, Water Assessment Section
Phil King, Manager, Emergency Response & Remedial Projects Section
Norm Weiss, Manager, Office of Planning & Program Development
Bill Wiley, Manager, Hydrology Section
Harley Hiett, Manager, Northern Regional Office
Technical Review Unit

EXTERNAL REVIEW CC LIST: (NOTE: ONLY THOSE OFFICES OR PERSONS CHECKED ON THE LIST ARE TO BE INCLUDED IN THE DISTRIBUTION OF THIS LIST ARE TO RECEIVE COPIES OF ATTACHED.)

CHECK MARK	PERSON AND/OR AGENCY
XX	U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION IX, MAIL DROP W1-G
XX	ARIZONA DEPARTMENT OF WATER RESOURCES, ATTN: CLAY CADY
XX	ARIZONA DEPARTMENT OF COMMERCE
X	BUREAU OF LAND MANAGEMENT (IF ON OR NEAR THEIR LAND), (FIND APPROPRIATE REGION FROM MAP)
	_____ NATIONAL FOREST (IF ON THEIR LAND)
X	~~Coconino~~ ACTIVE MANAGEMENT AGENCY (PHX., MARK FRANK, TOM CARR, PINAL, LESTER SNOW, TUCSON)
X	Coconino COUNTY HEALTH DEPARTMENT
	PIMA COUNTY WASTEWATER MANAGEMENT DEPARTMENT (INSIDE PIMA COUNTY ONLY)
X	NACOG ASSOCIATION OF GOVERNMENTS, (MAGE, PAG, CAAG, SEAGO, WACOG, NACOG)
X	Coconino COUNTY PLANNING AND ZONING COMMISSION
	FACILITY/DESIGN ENGINEER:
	CITY (DEPT.):
	ARIZONA STATE LAND DEPARTMENT (IF ON THEIR LAND)

DRAFT PERMIT

INTERNAL REVIEW

INTERNAL REVIEW LIST

INTERNAL REVIEW CC LIST: NOTE: ONLY THOSE OFFICES OR PERSONS CHECKED ON LIST ARE TO RECEIVE COPIES OF ATTACHED)

SKIP HELLERUD, MANAGER, WATER PERMITS UNIT	X
LYNDON R. HAMMON, MANAGER, PLAN REVIEW & PERMITS SECTION	X
SALLY L. MAPES, MANAGER, COMPLIANCE SECTION	X
JACK BALE, MANAGER, WATER ASSESSMENT	X
PHIL KING, ACTING MANAGER, EMERGENCY RESPONSE & REMEDIAL PROJECTS SECTION	X
NORM WEISS, ACTING MANAGER, OFFICE OF PLANNING & PROGRAM DEVELOPMENT	X
BILL WILEY, MANAGER, HYDROLOGY UNIT	X
DENNIS PONTIUS, MANAGER, TECHNICAL REVIEW UNIT	
BARRY ABBOTT, MANAGER, SOLID WASTE UNIT (for landfill permits)	
ROBERT HOLLANDER, MANAGER, CENTRAL REGIONAL OFFICE	
JIM MASTON, MANAGER, SOUTHERN REGIONAL OFFICE	
HARLEY HIETT, MANAGER, NORTHERN REGIONAL OFFICE	X

ARIZON.. .EPARTMENT OF ENVIRONMENTAL QU. .TY

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Technical Review Unit

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DRAFT FOR REVIEW AND DISCUSSION

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STATE OF ARIZONA

GROUNDWATER QUALITY PROTECTION PERMIT

Part I. AUTHORIZATION FOR FACILITY OPERATION SUCH THAT GROUNDWATER QUALITY OF THE STATE OF ARIZONA IS NOT ADVERSELY IMPACTED.

In compliance with the provisions of A.R.S. 36-1851 et seq; A.A.C. Title 9, Chapter 20, Article 2; A.A.C. Title 9, Chapter 21, Article 2; and conditions set forth in this permit:

Facility Name:	Operator:
Hermit Mine	Energy Fuels Nuclear, Inc. One Tabor Center, Suite 2500 1200 Seventeenth Street Denver, Colorado 80202

is authorized to operate the Hermit Mine, an underground uranium mine located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W 1/2 SW 1/4 - Gila and Salt River Base Line and Meridian.

This permit shall become effective on the date of signature and shall be valid for 15 years provided that the facility is operated and maintained in compliance with the specific conditions, general conditions, and information documented or referenced in Parts I, II, III and IV of this Permit and such that groundwater quality standards are not violated (Part V).

Brad L. Doores, Vice President
Legal and Regulatory Affairs
Energy Fuels Nuclear, Inc.

Signed this ____ day of

_____ 19 ___

Gerald Teletzke, Ph.D., Director
Arizona Department of Environmental Health

Signed this ____ day of

_____ 19 ___

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Part II. SPECIFIC CONDITIONS (R9-20-208.C)

A. Disposal/Containment Requirements

1. Facility Water Containment

The facility shall be designed, constructed and maintained such that there will be no migration of wastes or pollutants either directly to groundwater or to the vadose zone.

a. The operator shall be restricted to the disposal of mine water and runoff from a 23-acre uranium mine site to a lined impoundment. All waters pumped from the underground and all runoff from the 23-acre mine operation's area shall be directed to the lined impoundment. The 12.6-acre-foot impoundment shall be lined with synthetic material equivalent to 36 mil Hypalon. The underlying surface shall contain no gravels greater than 1/4 inch. The operator shall maintain a minimum of 3-acre feet (2.4 feet) of freeboard in operating the impoundment. The operator shall maintain a reserve area for the construction of an additional lined impoundment following authorization for an increase in the mine yard disturbance area. The use of enhanced evaporation techniques shall be allowed as an alternative for controlling water level in the lined impoundment.

b. The ore storage pads shall be constructed of crushed and compacted limestone and/or shale not less than 12 inches in thickness. The ore storage pads shall be sloped toward the edges and a runoff collection structure shall be constructed to ensure that all runoff from the ore piles shall be directed to the lined impoundment.

c. The operator shall construct storm water diversion structures, as referenced in "Hydrologic Evaluations for the Proposed Hermit Uranium Mine", Dames & Moore, 1987, to control waters from no less than a 100-year, 24-hour precipitation event. The diversion structures shall be constructed from borrow material from within the operations area and shall be protected with heavy riprap. All construction shall be performed to prevent runoff from the mine operations area.

2. Sewage Disposal

The operator shall construct a septic system with a design capacity of 1,000 gallons per day. The septic system shall be constructed in accordance with plans

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approved by the Mohave County Health Department. The septic system shall consist of a septic tank no less than 1,600 gallons and associated leach lines.

3. Unauthorized Materials

a. Materials authorized to be disposed of in the lined impoundment shall not include any materials that cause deterioration of the pond liner as indicated by the manufacturer's specifications for the liner material.

b. Materials authorized to be disposed of in all septic tanks are typical household sewage and shall not include mine water, motor oil, gasoline, paints, varnishes, laboratory wastes, solvents, fertilizers, pesticides or other materials not generally associated with toilet flushing, food preparation, laundry and personal hygiene.

c. Adequate supervision and operation shall be performed to ensure that all users of the facility are aware of and understand the containment/disposal requirements of Part II.A.1.

4. Discharge Source Limits

Total domestic wastewater flow from the facility shall not exceed 1,000 gallons per day.

5. Mining Limit

Total depth of the mine workings shall not exceed 1,500 feet below land surface.

6. Modification

This permit is issued contingent upon the above conditions. The permittee shall give ninety (90) days written advance notice to the Department of any modification to the above facility.

B. Monitoring Requirements, Record Keeping (R9-20-215)

1. Monitoring shall be conducted in three phases:

Phase I - Pre-Mining - Ambient Groundwater Characterization

Phase II - Mining - Evaluation of Possible Impacts

Phase III- Post-Mining - Evaluate the Effectiveness of Closure Activities.

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a. Phase I - Pre-Mining

The purpose of Phase I monitoring is to determine baseline, the ambient groundwater characteristics. Ambient groundwater shall be defined as the arithmetic mean plus two standard deviations of the chemical concentrations for each parameter.

(1) The regional aquifer shall be sampled at the monitoring well, Department of Water Resources Well Registry No. as located at and constructed as described in Section 7.c. of the Notice of Disposal. The operator shall monitor this water supply/monitoring well quarterly for the parameters listed in Part II.B.2.b.

(2) Water producing zones shall be monitored in the shaft during shaft sinking. Water quality and quantity shall be taken from every geologic unit which produces water at the time of shaft penetration and quarterly thereafter until mining commences.

b. Phase II - Mining

The purpose of monitoring during the mining phase is to determine what impacts, if any, the operation is having on the groundwater quality.

(1) Discharge Monitoring

On an annual basis the effluent from the septic system shall be sampled and analyzed for those parameters listed in Part II.B.2.b.

(2) Impoundment Monitoring

The operator shall inspect the impoundment for mechanical damage, seam failure and maintenance of freeboard on a daily basis.

(3) Groundwater Monitoring

The operator shall monitor the water supply/monitoring well, Department of Water Resources Well Registry No. , quarterly for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Static water level in the well shall be measured and recorded prior to sample pumping. If the well is

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used for production, pumping shall be suspended for 24 hours prior to observing the static water level. The operator shall evacuate at least one bore volume prior to sampling the monitoring well. The amount pumped shall be recorded. The water purged from the well shall be contained in the lined impoundment, stored in impervious containers, or used at the mine site.

(4) Mine Inflow Monitoring

Mine inflows shall be monitored in the shaft and at the mine sump. Within the shaft, water quality and quantity shall be monitored annually from each geologic unit which continues to produce water for the parameters listed in Part II.B.2.b. Water quality analysis shall not be subject to Maximum Groundwater Limits.

Inflows within the mine shall be monitored at the mine sump for quality by quarterly sampling and analysis for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Quantity of mine inflows shall be estimated on a quarterly basis taking into account the consumption of water by underground drilling and dust control, and the return flows from these operations. Any significant inflows shall be depicted on a mine map and submitted to ADEQ as part of the quarterly report.

c. Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

(1) The operator shall monitor the water supply/monitoring well, Division of Water Resources Well Registry No. , quarterly for the parameters in Part II.B.2.b.

(2) The sampling can be discontinued when the sampling location is no longer accessible or when the average concentrations of all parameters are less than or equal to the Maximum Groundwater Limit plus two standard deviations. The arithmetic average shall be calculated based on a five-point running

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average, the latest concentration and the four previous concentrations after closure.

Any individual concentrations that exceed the pre-mining mean concentration plus four standard deviations shall be rejected as anomalous and not used for calculation of the five-point running averages unless two samples in a row exceed the mean concentration.

2. Constituents for Analyses

Two categories of constituents for analysis shall be used while monitoring - indicator parameters with Alert Levels and comprehensive list of parameters with Maximum Groundwater Limits:

a. Indicator Parameters

If laboratory chemical analyses for a water sample would detect concentrations of gross alpha, gross beta, and/or any of the selected trace elements in excess of the alert levels, the source for the water sample would be resampled and analyzed for the comprehensive list of parameters:

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PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	0.025	1	206.2
Barium	0.5	2	208.1
Cadmium	0.005	1	213.2
Copper	0.5	2	220.1
Iron	0.15	2	236.1
Lead	0.025	1	239.2
Manganese	Reserved*	2	242.1
Mercury	0.001	1	245.1
Nitrate (as N)	5.0	3	---
Selenium	0.005	1	270.2
Silver	0.025	2	272.1
Zinc	5.0	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	5.0	4,13	703
Gross Beta	5.0	4,13	703

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved*	4	403
Arsenic	0.05	1	206.2
Barium	1.0	2	208.1
Bicarbonate	Reserved*	3	305.1
Cadmium	0.010	1	213.2
Calcium	Reserved*	2	215.1
Carbonate	Reserved*	4	403
Chloride	Reserved*	3	325.3
Chromium (total)	0.05	1	218.2
Copper	1.0	2	220.1

(1)Standard references are listed on Attachment I to this Permit.

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(Cont'd.)

PARAMETER	MAXIMUM GROUND-WATER LIMITS	REF I.D.(1)	METHOD OF ANALYSIS
	(milligrams per liter)		
Fluoride	2.4	3	340.2
Iron	0.3	2	236.1
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Manganese	Reserved*	2	243.1
Mercury	0.002	1	245.1
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Potassium	Reserved*	2	258.1
Selenium	0.01	1	270.2
Silver	0.05	2	272.1
Silica	Reserved*	-	---
Sodium	Reserved*	2	273.1
Sulfate	Reserved*	3	375.3
Total Dis-solved Solids	Reserved*	3	160.3
Zinc	Reserved*	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved*	3	120.1
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Gross Alpha	15	4,13	703
Gross Beta	50	4,13	703
Total Uranium	Reserved*	9,10	---
Thorium 230	Reserved*	9,10	---
Radium 226	Reserved*	4,7	705,706

(1)Standard references are listed on Attachment I to this Permit.

* Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

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(1) If a primary or secondary drinking water standard or Maximum Groundwater Limit has been established for a parameter by Arizona State regulatory agencies, and if the arithmetic mean plus two standard deviations of concentrations of the parameter in groundwater samples obtained during the pre-mining period does not exceed the drinking water standard, the Maximum Groundwater Limit shall be the drinking water standard.

If the arithmetic mean plus two standard deviations of concentrations of the parameter exceeds an established primary or secondary drinking water standard, the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of concentration of the parameter in groundwater samples.

(2) If a primary or secondary drinking water standard has not been established by the regulatory agencies for a parameter and the parameter is detected in groundwater samples during the pre-mining period, or if the arithmetic mean plus two standard deviations of concentrations in groundwater samples obtained during the pre-mining period exceeds the established drinking water standard, then the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of the pre-mining concentrations.

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3. Monitoring Forms

All monitoring results shall be recorded and reported on the Self-Monitoring Form supplied by ADEQ. This form should be given to the laboratory performing the analysis.

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The permittee shall submit a report summarizing progress of the mine development and monitoring results on an annual basis. The report shall contain a current site plan, a map of the underground mine workings including elevations, and shall indicate the locations of all monitoring sites required by this permit. All analytical monitoring results for the previous quarter shall be postmarked no later than

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DRAFT FOR REVIEW AND DISCUSSION

the 28th day of the second month following the completed reporting period as indicated below:

Self-Monitoring Report Forms for	are due by
1st Quarter (Jan, Feb, Mar)	May 28
2nd Quarter (Apr, May, Jun)	Aug 28
3rd Quarter (Jul, Aug, Sep)	Nov 28
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All laboratory reports shall be submitted to the following location:

Arizona Department of Environmental Quality
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C. Contingency Requirements

1. Should any of the monitoring results required by this permit exceed the alert level specified for a particular parameter, the permittee shall immediately notify the Department of the apparent exceedance and resample to determine the validity of the sample result.

2. In the event that a confirmed exceedance of the Maximum Groundwater Limit specified in Part II.B.2.b. occurs at the monitoring well, the operator shall submit a report within 60 days which assesses the impacts from the exceedance and the mining operation.

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DRAFT FOR REVIEW AND DISCUSSION

2. Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of clay, shale or bentonite plugs in both the main shaft, the air shaft and the monitoring well.

3. Following the expiration date of this permit, the permittee shall continue monitoring listed in Part II.B.1.c. on a quarterly basis. In the event that a Maximum Groundwater Limit as described in Part II.B.2.b. is confirmed to be exceeded, the permittee shall immediately notify the Department and, within 30 days of such a violation, submit a plan to mitigate the effects of the violation.

4. In the event that the septic system is abandoned for any reason, any remaining septage shall be disposed of off-site at a location approved to accept such wastes.

E. Compliance Schedule (R-20-219)

1. Within 60 days of the completion of the main shaft sinking, the operator shall submit an analysis showing that the collection sumps are impermeable and the sumps do not leak or the operator shall provide a plan for containment.

2. The operator shall notify the Water Pollution/UST Compliance Unit no less than 7 days prior to the installation of the liner specified in Part II.A.1.

DRAFT FOR REVIEW AND DISCUSSION

Part III. REFERENCES: PERTINENT INFORMATION

A. References

The terms and conditions set forth in this permit have been developed based upon the information contained in the following:

1. Groundwater Field Inspection Form(s) dated _____

2. Notice of Disposal dated June 14, 1987

3. Groundwater Impact Review dated August 4, 1987

4. Plan Review File Number _____

5. Permit Application dated _____

6. Groundwater Impact Review dated _____

7. Amendments to 2 and 4 dated _____

8. Public Notice dated September 14, 1987

9. Public Hearing comments, correspondence letters, and any additional supplemental information contained in the facility permit file.

10. Other _____

B. Facility Information

1. Facility Contact Person _____

2. Address _____

3. Emergency Telephone Number: Business ( )

Home ( )

The Department shall be notified within 30 days of a change in the facility contact person.

4. Landowner of Facility Site B. L. M.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Inter-Office Memorandum

DATE: October 19, 1987

TO: Miguel Santiago, EHS II
Water Permits Unit

THRU: Debra Daniel, Manager DD
State Permits Hydrology Unit

FROM: Michael Leach, Hydrologist MDL
State Permits Hydrology Unit

RE: Hermit and Pinenut Mines

Due to the great similarity between the above referenced facilities, their Draft Groundwater Quality Protection Permits have been reviewed together and the following comments have been made:

1) Upon obtaining all of Phase I (pre-mining) water quality data as described in Part II.B.1.a of the draft permits, a report which summarizes the water quality data and establishes the Maximum Groundwater Limit (MGL) for each sampling parameter should be submitted to ADEQ for each facility. MGL's should be assigned using the procedure described in Part II.B.2.b. of the draft permits.

2) The proposed Phase III (post-mining) groundwater sampling frequency and subsequent data manipulation used to determine the eventual cessation of sampling activities (described in Part II.B.1.c.2. of the draft permits) should be changed. The problem is that the draft permit does not take into consideration the potential length of time necessary for any contaminated water from the mine shaft to travel several hundred feet to the regional water table. If the vadose zone is not substantially fractured, travel times could take several years, depending on the vertical permeability of the vadose zone rock formations. Therefore, a long-term, post-closure sampling program should be implemented. This sampling program should last 15 years with semi-annual sampling of the on-site water supply/monitor well. (Hermit and Pinenut Mine) and the spring at Willow Springs (Pinenut Mine). Water quality analyses should include the parameters listed in Part II.B.2.b. of the draft permit, and MGL's should remain the same as calculated for Phase II (mining) groundwater monitoring.

3) The contingency requirements listed in Part II.C.2. of the Pinenut Mine draft permit should include a report which assesses the impacts of a confirmed exceedence of an MGL occurring at the spring at Willow Springs.

ML:dl

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

EVAN MECHAM, GOVERNOR
Gerald Teletzke, Ph.D.,
Director

September 4, 1987

Mr. Harold R. Roberts
Senior Project Engineer
Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 200
1200 Seventeenth Street
Denver, Colorado 80202

Dear Mr. Roberts:

RE: Hermit Mine - Groundwater Quality Protection Permit No. G-0035-08

A Notice of Disposal has been received and given a preliminary review for the above referenced facility. In accordance with A.A.C., Title 9, Chapter 20, Section 205 of the Water Pollution Control Permit System, this letter serves as notification:

__X__ 1. Of our intent to issue a Groundwater Quality Protection Permit. You should, however, be reminded that operations may not commence until a groundwater permit is issued.

_____ 2. The issuance of the permit is contingent on technical approval of plans and specifications by ADEQ, Technical Review Unit or the appropriate County Health Department.

_____ 3. That the facility does not comply with the criteria listed in R9-20-208.A, and as such, a full permit application will be required. The regulations (R9-20-208.A) require you to first submit a proposal for a permit application. It is suggested you contact this office to arrange a pre-proposal meeting. I have enclosed a copy of the "Outline of Requirements for a Permit Application".

_____ 4. That the NOD is incomplete, and further information will be required to complete the preliminary review. (see attachment)

__X__ 5. Other - Construction of the facility may commence at your own risk that requirements may change prior to issuance of the final permit. However, no disposal is permitted until the permit is issued.

If you have any questions, please call me at 257-6806.

Sincerely,

Carol Russell
Water Permits Unit

CR:mm

cc: Hydrology Unit
Technical Review Unit
William A. Almas, Energy Fuels Nuclear, Inc.

The Department of Environmental Quality is An Equal Opportunity Affirmative Action Employer

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561

August 31, 1987



Ms. Carol Russell
Water Permits Unit
Arizona Department of Health Services
Central Palm Plaza Building
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Notice of Disposal

Dear Ms. Russell:

Energy Fuels Nuclear, Inc. requests authorization to construct a septic system at the Hermit mine site located in Coconino County, Arizona. Inflow to the system will consist of domestic sewage and wash water from the shower facilities. No industrial wastes or shop wash water will drain to the septic tank and leach field.

If you have any questions concerning this matter, please contact me at our Denver office.

Very truly yours,

William J. Almas
Environmental Coordinator

WJA:smm

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561

June 10, 1987

Ms. Carol Russell
Water Permits Unit
Arizona Department of Health Services
State Health Building
1740 West Adams Street
Phoenix, Arizona 85007

Re: Notice of Disposal Form - Hermit Mine

Dear Ms. Russell:

Please find enclosed the completed Notice of Disposal form and enclosures for the Hermit mine located in Mohave County, Arizona. Please note that the Hermit mine has been designated as a new facility for your permitting process.

If you have any questions or require additional information, please feel free to contact me.

Very truly yours,

W. J. Almas
Environmental Engineer

WJA:smm

Enclosure

cc: M. D. Vincelette, Energy Fuels
B. L. Doores, Energy Fuels
R. B. Smith, Energy Fuels
H. R. Roberts, Energy Fuels
R. D. Hembree, Energy Fuels



BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

ATTN: William J. Almas

LGN: 6539

Sample Identification	SO_4 mg/l	TDS mg/l	TSS mg/l	Specific Conductance µmho/cm
Hermitt HU 536-024	2300	4120	87	3950

Water sample HU 536-024 was collected on 2/12/87 from a borehole inside of the breccia pipe (pg. 204)

The R/M water well (55-518877) was not drilled until 1/12/88

Phenols mg/l	Turbidity JTU	NH_4 as N mg/l	S mg/l	U Dissolved mg/l
<0.01	2	0.4	<0.1	0.264 *264 ppb*

U Suspended mg/l	Gross Alpha pCi/l ±Precision*	Gross Beta pCi/l ±Precision*	Th 230 pCi/l ±Precision*
0.0106	750 ± 70	390 ± 20	1.3 ± 0.9

Uranium is is the greatest contributor to gross alpha. It is not possible to have 750 pCi/L of alpha radiation and only have a 264 ppb of dissolved U

Ra 226 pCi/l ±Precision*	Pb 210 pCi/l ±Precision*	Po 210 pCi/l ±Precision*	Ra 228 pCi/l ±Precision*
300 ± 10	104 ± 2	5.9 ± 1.1	1.5 ± 1.0

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

EXHIBIT #2

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

ATTN: William J. Almas

Client No. Log No. 6568 Client PO No.

Sample Type: water

Date Collected: Date Received: 2/27/87 Date Reported: 3/31/87

Sample Identification	As mg/l	Ba mg/l	Cd mg/l	Ca mg/l	Cr mg/l
Hermit HU 536-031 #1	0.004	<0.1	0.001	547	0.02

Water sample HU 536-031 was collected on 2/24/87 from a borehole outside of the breccia pipe (pg. 204)

Cu mg/l	Fe mg/l	Pb mg/l	Mg mg/l	Mn mg/l
0.01	29.0	0.002	185	0.74

"It should be noted that the water quality within the pipe varies significantly from the water quality outside the pipe." page 204

Hg mg/l	Mo mg/l	K mg/l	Se mg/l	Ag mg/l
<0.0002	<0.1	23.7	0.002	0.01

Na mg/l	Zn mg/l	CO_3 as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	B mg/l
67.4	0.131	<1	40	0.46

Cl mg/l	Specific Conductance µmho/cm	CN mg/l	F mg/l	NO_3 as N mg/l
26	4180	<0.001	1.47	0.13

Approved by

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

ATTN: Bill Almas

LGN: 6568

Sample Identification	pH units	TDS mg/l	TSS mg/l	SO_4 mg/l	S mg/l
Hermit HU 536-031 #1	7.43	3350	84	2140	<1

	Phenols mg/l	Turbidity JTU	NH_4 as N mg/l	U Dissolved mg/l	U Suspended mg/l
	<0.01	2	0.30	0.0215	0.0031

As a general rule, the gross alpha in pCi/L should be roughly 2/3 of the U concentration in parts per billion/micrograms per liter
230 pCi/L ≈340 ppb

21.5 ppb

Gross Alpha pCi/l ±Precision*	Gross Beta pCi/l ±Precision*	Th 230 pCi/l ±Precision*	Ra 226 pCi/l ±Precision*
230 ± 30	92 ± 13	0.4 ± 1.2	53 ± 2

Pb 210 pCi/l ±Precision*	Po 210 pCi/l ±Precision*	Ra 228 pCi/l ±Precision*
6.5 ± 2.1	0.2 ± 0.6	0.8 ± 0.9

* Variability of the radioactive disinegration process (counting error) at the 95% confidence level, 2σ

Approved by

EXHIBIT #1

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

ATTN: William J. Almas

Client No. Log No. 6539 Client PO No.

Sample Type: water

Date Collected: 2/12/87 Date Received: 2/16/87 Date Reported: 3/31/87

Sample Identification	As mg/l	Ba mg/l	Cd mg/l	Ca mg/l	Cr mg/l
Hermitt HU 536-024	0.008	<0.1	0.002	544	0.02

	Cu mg/l	Fe mg/l	Pb mg/l	Mg mg/l	Mn mg/l
	0.02	22.7	0.008	219	0.72

	Hg mg/l	Mo mg/l	K mg/l	Ag mg/l	Se mg/l
	<0.0002	0.2	46.2	0.01	0.002

	Na mg/l	Zn mg/l	CO_3 as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	B mg/l
	236	0.475	<1	222	0.63

	Cl mg/l	CN mg/l	F mg/l	NO_3 as N mg/l	pH units
	127	<0.001	1.68	<0.01	7.22

Approved by _____

H-4515.124

[redacted]ARIZONA DEPARTMENT OF HEALTH SERVI[redacted]

Inter-Office Memorandum

DATE: August 4, 1987

TO: Carol Russell, EHS II
Water Permits

THRU: Debra Daniel, Manager DD
State Permits Hydrology Unit

FROM Michael Leach, Hydrologist MDL
State Permits Hydrology Unit

RE: Hermit Mine

The Notice of Disposal (NOD), Draft Environmental Assessment (DEA), and reports on the hydrologic and groundwater conditions for the proposed Hermit Mine have been reviewed and the following comments have been made:

This is incorrect, EF was aware there was perched water at 903' bls at mine site

1) Due to the limited lateral extent of the perched aquifers in the area, the localized dewatering of the perched aquifer into the mine shaft would only effect the on-site stockpond well. This well is owned by Energy Fuels Nuclear and is the only perched aquifer well known to exist in the site vicinity.

Depth to perched at 503919 - 370' bls

Depth to perched at mineshaft & well 517832 - 903' bls

Perched aquifer was in contact with Toroweap ore body

R/M Well 518877 was uncased between 1,796'-3,030' bls

2) The perched water underlying the site which will most likely enter the mine shaft upon penetration of the perched aquifer layers does not appear to be a problem considering that the water entering the mine workings will be pumped to the surface into the evaporation pond. In the event of small quanities of perched water percolating beneath the mine shaft, the great depth to groundwater (1000') beneath the mine shaft and the thick layers of mudstone and limestones (with high adsorptive capacities for uranium) which separate the bottom of the shaft from the aquifer would indicate that there is very little chance for perched water contaminating the regional aquifer. However, due to the hazardous nature of the potential contaminants (radioactive uranium) an extensive monitoring program should be implemented. This monitoring program should be the same as required for the Canyon Mine (Groundwater Quality Protection Permit No. G-0004-03) except that the monitoring of springs will not be necessary due to their absence in the site vicinity.

3) Well construction details for the proposed on-site monitor/production well should be submitted for review to ensure that the well is properly constructed and representative samples from the regional aquifer can be obtained.

4) A contingency plan is needed.

ML:dl

ARIZONA DEPARTMENT OF HEALTH SERVICES

Inter-Office Memorandum

DATE: August 4, 1987

TO: Carol Russell, EHS II
Water Permits

THRU: Debra Daniel, Manager DLD
State Permits Hydrology Unit

FROM Michael Leach, Hydrologist MDL
State Permits Hydrology Unit

RE: Hermit Mine

The Notice of Disposal (NOD), Draft Environmental Assessment (DEA), and reports on the hydrologic and groundwater conditions for the proposed Hermit Mine have been reviewed and the following comments have been made:

Well 517832 was drilled to 975' bls in the perched aquifer

1) Due to the limited lateral extent of the perched aquifers in the area, the localized dewatering of the perched aquifer into the mine shaft would only effect the on-site stockpond well. This well is owned by Energy Fuels Nuclear and is the only perched aquifer well known to exist in the site vicinity.

Sump was 1,130' bls and evaporation pond was divided into two ponds

2) The perched water underlying the site which will most likely enter the mine shaft upon penetration of the perched aquifer layers does not appear to be a problem considering that the water entering the mine workings will be pumped to the surface into the evaporation pond. In the event of small quanities of perched water percolating beneath the mine shaft, the great depth to groundwater (1000') beneath the mine shaft and the thick layers of mudstone and limestones (with high adsorptive capacities for uranium) which separate the bottom of the shaft from the aquifer would indicate that there is very little chance for perched water contaminating the regional aquifer. However, due to the hazardous nature of the potential contaminants (radioactive uranium) an extensive monitoring program should be implemented. This monitoring program should be the same as required for the Canyon Mine (Groundwater Quality Protection Permit No. G-0004-03) except that the monitoring of springs will not be necessary due to their absence in the site vicinity.

3) Well construction details for the proposed on-site monitor/production well should be submitted for review to ensure that the well is properly constructed and representative samples from the regional aquifer can be obtained.

4) A contingency plan is needed.

ML:dl

HYDROLOGIC REVIEW

Facility Name: Hermit Mine

Date: July 24, 1987

Hydro Permit #: H-4515.124

Location: B(38-4)17 W½ SW¼

Type of Facility: Uranium Mine

Type of Discharge: Water produced during mining operations.

Recommendations: Requesting additional information dealing with the designs of the holding pond and diversion trenches, ore-pad liner, pond liner, construction details of the on-site monitor well, and cintinuency and closure plans. Monitoring being proposed for the site is similar to that of the Canyon Mine except that spring monitoring will not be required due to a lack of springs in the vicinity.

Volume of Discharge: ?

Method of Discharge: Percolation of mining operations water through uranium formation, septage effluent.

Quality of Discharge: ?

Constituents of Concern: Radioactive constituents, heavy metals, and nitrates.

Monitoring: No groundwater or effluent sampling has been proposed.

Depth to Water: about 2000'

Direction of Groundwater Flow: ?

Location of Wells in Area: Well in perched water zone about 0.5 miles to the southwest and proposed on-site monitor well.

Uses of Groundwater in Area: Water supply for facility only.

Ambient Water Quality: Ambient water quality data will be obtained from the on-site well upon installation.

Ambient Constituents that exceed a standard: No data as of yet.

Discussion: Facility is a uranium mine which extends 1,100 feet into the subsurface along a breccia pipe. Major concerns include the deep percolation of cascading perched water down into the mine shaft, prevention of storm water run-on and run-off from the facility, lining of the ore pads, and lining of the evaporation pond.

Reviewer: Michael Leach

TO Debra Daniel
Hydrology Unit

FROM Carol Russell
thru
Roger Kennett

SUBJECT Hermit Mine File No. 87-115 DATE 7/9/87

MESSAGE

For your review and comment attached please find the Hermit Mine N.O.D and associated information. An incomplete letter has been sent because of statutory deadlines. However, your assistance is requested regarding the potential hydrologic effects of this proposed mine.

SIGNED

REPLY Topics of concern: 1) dewatering "insoable" perched aquifers
2) cascading waters after closure (the shaft is in a drainage) The maps are available in our office
3) stockpiling of low grade ore.

Please respond by July 23 Thanks

SIGNED Carol Russell DATE 7/9/87

REDIFORM 4S 472 SEND PARTS 1 AND 3 INTACT - PART 3 WILL BE RETURNED WITH REPLY. carbonless POLY PAK (50 SETS) 4P472

TO Debra Daniel
Hydrology Unit

FROM Carol Russell
for
Roger Kennett

SUBJECT Hermit Mine File No. 87-115 DATE 7/9/87

MESSAGE For your review and comment,
Attached please find the information contained in the Hermit Mine N.O.D. An incomplete letter has been sent. Your assistance is requested regarding: a) Are the perched aquifers useable? b) Is the proposed methods to prevent "disposal" sufficient; and SIGNED

REPLY c) Are the closure plans adequate?
Please respond by July 23. Thank you for your assistance.

Carol Russell

SIGNED DATE / /

REDIFORM 4S 472 SEND PARTS 1 AND 3 INTACT - PART 3 WILL BE RETURNED WITH REPLY. carbonless POLY PAK (50 SETS) 4P472

DETACH AND FILE FOR FOLLOW-UP

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

EVAN MECHAM, GOVERNOR
Gerald Teletzke, Ph.D., Director

July 9, 1987

Mr. William J. Almas
Environmental Engineer
Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202

Dear Mr. Almas:

RE: Hermit Mine, File No. 87-115

A Notice of Disposal has been received and given a preliminary review for the above referenced facility. In accordance with A.A.C., Title 9, Chapter 20, Section 205 of the Water Pollution Control Permit System, this letter serves as notification:

_____ 1. Of our intent to issue a Groundwater Quality Protection Permit You should, however, be reminded that operations may not commence until a groundwater permit is issued.

__X__ 2. The issuance of the permit is contingent on technical approval of plans and specifications by ADEQ, Technical Review Unit, or the appropriate County Health Department.

_____ 3. That the facility does not comply with the criteria listed in R9-20-208.A, and as such, a full permit application will be required. The regulations (R9-20-208.A) require you to first submit a proposal for a permit application. It is suggested you contact this office to arrange a pre-proposal meeting. I have enclosed a copy of the "Outline of Requirements for a Permit Application".

__X__ 4. That the NOD is incomplete, and further information will be required to complete the preliminary review. (see attachment)

__X__ 5. The file has been submitted to the Hydrology Unit for their review. Therefore, additional questions may arise. I will keep you apprised of any further developments.

Sincerely,

Carol Russell

Carol Russell
Water Permits Unit

CR:mm

cc: Hydrology Section
Technical Review Unit

The Department of Environmental Quality is An Equal Opportunity Affirmative Action Employer

FACILITY NAME Hermit Mine DATE July 6, 1987

NOTICE OF DISPOSAL CHECKLIST

LINE #	GENERAL DESCRIPTION	N/A	COMPLETE	INCOMPLETE
1 a	Facility Name		X	
1 b	Facility address or describe location		X	
1 c	Facility manager, address & telephone # Roger B. Smith?			X
1 d & e	Owners name, address and telephone #		X	
1 f	Landowner of the facility site B.L.M.?			X
1 g	Facility's design consultant	X		
	Name of consultant			
	Firm			
	Address			
	Telephone #			
1 h	Type of Permit		X	
1 i	Type of facility requesting permit		X	
2 a	Topographic Map		X	
	Geographic location of facility		X	
	All disposal locations and springs		X	
	All groundwater supply wells within 1/4 mile radius			X
	Identified use of each well on an attachment or spring			X
2 b	Latitude & Longitude of all disposal locations on map		X	
3 a	Type of Facility(s)		X	
3 b	Nature of Activity conducted at facility(s)		X	
3 c	SIC codes for activities conducted at facility		X	
4	Date facility began/will begin operations			X
	Note: No disposal activities can take place until the permit is issued. ie. septic system, waste rock			
5	Facility(s) operational lifetime		X	
6	List any other environmental permits issued Air Quality Permit NRC?			X
7 a	Describe disposal activities at facility not all disposal activities were discribed			X
7 b	Any control measures and treatment process designed and operated to protect groundwater quality from the effects of disposal. If none, so indicate. septic system?			X

FACILITY NAME Hermit Mine DATE July 6, 1987

NOTICE OF DISPOSAL CHECKLIST

LINE #	GENERAL DESCRIPTION	N/A	COMPLETE	INCOMPLETE
1 a	Facility Name		X	
1 b	Facility address or describe location		X	
1 c	Facility manager, address & telephone # Roger B. Smith?			X
1 d & e	Owners name, address and telephone #		X	
1 f	Landowner of the facility site B.L.M.?			X
1 g	Facility's design consultant	X		
	Name of consultant			
	Firm			
	Address			
	Telephone #			
1 h	Type of Permit		X	
1 i	Type of facility requesting permit		X	
2 a	Topographic Map		X	
	Geographic location of facility		X	
	All disposal locations and springs		X	
	All groundwater supply wells within 1/4 mile radius			X
	Identified use of each well on an attachment or spring			X
2 b	Latitude & Longitude of all disposal locations on map		X	
3 a	Type of Facility(s)		X	
3 b	Nature of Activity conducted at facility(s)		X	
3 c	SIC codes for activities conducted at facility		X	
4	Date facility began/will begin operations			X
	Note: No disposal activities can take place until the permit is issued. ie. septic system, waste rock			
5	Facility(s) operational lifetime		X	
6	List any other environmental permits issued			X
	Air Quality Permit			
	NRC?			
7 a	Describe disposal activities at facility not all disposal activities were discribed			X
7 b	Any control measures and treatment process designed and operated to protect groundwater quality from the effects of disposal. If none, so indicate.			X
	septic system?			

File Copy

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

EVAN MECHAM, GOVERNOR
Gerald Teletzke, Ph.D., Director

July 9, 1987

Mr. William J. Almas
Environmental Engineer
Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202

Dear Mr. Almas:

RE: Hermit Mine, File No. 87-115

A Notice of Disposal has been received and given a preliminary review for the above referenced facility. In accordance with A.A.C., Title 9, Chapter 20, Section 205 of the Water Pollution Control Permit System, this letter serves as notification:

_____ 1. Of our intent to issue a Groundwater Quality Protection Permit You should, however, be reminded that operations may not commence until a groundwater permit is issued.

__X__ 2. The issuance of the permit is contingent on technical approval of plans and specifications by ADEQ, Technical Review Unit, or the appropriate County Health Department.

_____ 3. That the facility does not comply with the criteria listed in R9-20-208.A, and as such, a full permit application will be required. The regulations (R9-20-208.A) require you to first submit a proposal for a permit application. It is suggested you contact this office to arrange a pre-proposal meeting. I have enclosed a copy of the "Outline of Requirements for a Permit Application".

__X__ 4. That the NOD is incomplete, and further information will be required to complete the preliminary review. (see attachment)

__X__ 5. The file has been submitted to the Hydrology Unit for their review. Therefore, additional questions may arise. I will keep you apprised of any further developments.

Sincerely,

Carol Russell

Carol Russell
Water Permits Unit

CR:mm

cc: Hydrology Section
Technical Review Unit

The Department of Environmental Quality is An Equal Opportunity Affirmative Action Employer

FACILITY NAME Hermit Mine DATE July 6, 1987

NOTICE OF DISPOSAL CHECKLIST

LINE #	GENERAL DESCRIPTION	N/A	COMPLETE	INCOMPLETE
1 a	Facility Name		X	
1 b	Facility address or describe location		X	
1 c	Facility manager, address & telephone # Roger B. Smith?			X
1 d & e	Owners name, address and telephone #		X	
1 f	Landowner of the facility site B.L.M.?			X
1 g	Facility's design consultant	X		
	Name of consultant			
	Firm			
	Address			
	Telephone #			
1 h	Type of Permit		X	
1 i	Type of facility requesting permit		X	
2 a	Topographic Map		X	
	Geographic location of facility		X	
	All disposal locations and springs		X	
	All groundwater supply wells within 1/4 mile radius			X
	Identified use of each well on an attachment or spring			X
2 b	Latitude & Longitude of all disposal locations on map		X	
3 a	Type of Facility(s)		X	
3 b	Nature of Activity conducted at facility(s)		X	
3 c	SIC codes for activities conducted at facility		X	
4	Date facility began/will begin operations			X
	Note: No disposal activities can take place until the permit is issued. ie. septic system, waste rock			
5	Facility(s) operational lifetime		X	
6	List any other environmental permits issued			X
	Air Quality Permit			
	NRC?			
7 a	Describe disposal activities at facility not all disposal activities were discribed			X
7 b	Any control measures and treatment process designed and operated to protect groundwater quality from the effects of disposal. If none, so indicate. septic system?			X

LINE #	GENERAL DESCRIPTION	N/A	COMPLETE	INCOMPLETE
7 c	Existing groundwaters uses of receiving aquifer no uses listed			X
7 d	Depth of groundwater		X	
	Source of data		X	
	Date of measurement		X	
	R/M supply well was not installed until 6 months after this report		?	
7 e	Analytical report of ground water quality from:			
	Groundwater supply well(s) on the facility		X	
	Groundwater supply well(s) within 1/4 mile or springs			X
	Analysis to include values for the following:			
	Microbiological			X
	Inorganic chemicals			X
	Radiochemicals			X
	Secondary contaminants			X
	Priority pollutants			X
	Organic chemicals			X
	Others			X
	Include source and date of sampling			X
8 a	Types of Wastes generated		X	
8 b	Analytical report of waste stream, septic tank values for:			X
	Microbiological			X
	Inorganic chemicals			X
	Radiochemicals			X
	Secondary contaminants			X
	Priority pollutants			X
	Organic chemicals			X
	Others			X
	Include source and date of sampling			
8 c	Disposal Schedule Hours/ per day (septic system)			X
	Days/ per year			X
	Seasonal distribution			X
8 d	Estimated flow rate(s) of disposal			X
9	Describe any existing groundwater monitoring programs (attach reports if available)		X	
10	Other data that in the judgement of the owner/operator, demonstrates that the facility qualifies for a groundwater quality protection permit.		X	
11	Certification & signature		X	
12	Site plans to include:			X
	Septic tank/wastewater treatment plant location and capacities			X
	leach lines/ seepage pits/ pond location			X
	depth and size of seepage pits			X
	Percolation data, soil profile data			X
	Project area size			X
	Flow rate			X
	5-day on-site storage, 10-year, 24 hour storm containment			

ARIZONA DEPARTMENT OF HEALTH SERVICES

Rush

BRUCE BABBITT, Governor
LLOYD F. NOVICK, M.D., M.P.H., Director

Mr. William J. Almas
Environmental Engineer
Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO ~~80507~~ 80202

Re: Hermit Mine, File No. 87-115

Dear Mr. Almas

A Notice of Disposal has been received and given a preliminary review for the above referenced facility. In accordance with ACRR Title 9, Chapter 20, Section 205 of the Water Pollution Control Permit System, this letter serves as notification:

_____1. Of our intent to issue a Groundwater Quality Protection Permit.

__X__2. The issuance of the permit is contingent on technical approval of plans and specifications by ADHS, Technical Review Unit, or the appropriate County Health Department.

_____3. That the facility does not comply with the criteria listed in R9-20-208.A, and as such, a full permit application will be required. The regulations (R9-20-208.A) require you to first submit a proposal for a permit application. It is suggested you contact this office to arrange a pre-proposal meeting. Enclosed is a copy of the "Outline of Requirements for a Permit Application."

__X__4. That the NOD is incomplete, and further information will be required to complete the preliminary review. (See attachment)

_____5. Other The file has been submitted to the Hydrology Unit for their review. Therefore additional questions may arise. I will keep you apprised of any further developments.

Sincerely,

Carol Russell
Water Permits Unit

Enclosure

cc: Hydrology Unit
Technical Review Unit

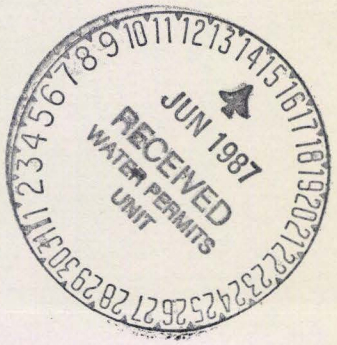
The Department of Health Services is An Equal Opportunity Affirmative Action Employer.

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561

June 10, 1987



Ms. Carol Russell
Water Permits Unit
Arizona Department of Health Services
State Health Building
1740 West Adams Street
Phoenix, Arizona 85007

Re: Notice of Disposal Form - Hermit Mine

Dear Ms. Russell:

Please find enclosed the completed Notice of Disposal form and enclosures for the Hermit mine located in Mohave County, Arizona. Please note that the Hermit mine has been designated as a new facility for your permitting process.

If you have any questions or require additional information, please feel free to contact me.

Very truly yours,

W. J. Almas
Environmental Engineer

WJA:smm

Enclosure

cc: M. D. Vincelette, Energy Fuels
B. L. Doores, Energy Fuels
R. B. Smith, Energy Fuels
H. R. Roberts, Energy Fuels
R. D. Hembree, Energy Fuels



NOTICE OF DISPOSAL FORM

1) a. FACILITY NAME: Hermit Mine

b. FACILITY OWNER: Energy Fuels Nuclear, Inc.

c. NAME, TITLE, ADDRESS, AND TELEPHONE NUMBER OF CONTACT PERSON FOR FACILITY:

NAME: William J. Almas

TITLE: Environmental Coordinator

MAILING ADDRESS: One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202

TELEPHONE NUMBER: (303) 623-8317

d. ADDRESS AND TELEPHONE NUMBER OF FACILITY:

MAILING ADDRESS: Energy Fuels Nuclear, Inc.
P. O. Box 36
Fredonia, Arizona 86022

TELEPHONE NUMBER: (602) 643-7321

e. FACILITY LOCATION INFORMATION:

Twenty-one miles southwest of Fredonia, Arizona

Mohave County, Arizona

Township 38 West

Range 4 West

Section 17 W 1/2 SW 1/4

f. DESCRIBE ACCESS TO FACILITY:

From Fredonia, Arizona take Highway 389, 8.5 miles to Mt. Trumball Road; 14.2 miles south on Mt. Trumball Road to site access road and southeast 1.5 miles to project site.

g. LANDOWNER OF FACILITY SITE:

U. S. Bureau of Land Management

h. TYPE OF PERMIT YOU ARE APPLYING FOR:

AREA PERMIT_____ INDIVIDUAL FACILITY PERMIT__X__

i. TYPE OF FACILITY REQUESTING PERMIT:

NEW___X___ EXISTING_____

2. a. ATTACH A TOPOGRAPHIC MAP (PREFERABLY A 7.5 MINUTE QUADRANGLE BASE), SHOWING THE GEOGRAPHIC LOCATION OF THE FACILITY(S) AND ALL DISPOSAL LOCATIONS. IN ADDITION, SHOW THE LOCATION OF ANY EXISTING GROUND-WATER WITHDRAWAL WELLS WITHIN THE APPROXIMATE VICINITY (1/4 MILE RADIUS) OF THE DISPOSAL AREA AND IDENTIFY THE USE OF EACH WELL (I.E. INDUSTRIAL WELLS, DRINKING WATER SUPPLY WELLS, ETC.). (IF APPLYING FOR AN AREA PERMIT AS DESCRIBED IN R9-20-211, INDICATE ON THE MAP THE LOCATION OF EACH FACILITY AND DISPOSAL LOCATION IN THE PROPOSED PERMITTED AREA).

Refer to Plates 1 and 2 of the "Plan of Operations" for location of the facility. The only known ground-water well within 1/4 mile of the facility is located within the operations area of the proposed mine. The well was an exploration borehole which was completed as a stock well when water was encountered. The well is located near the Hermit breccia pipe, but not within it. This well was drilled and completed by Energy Fuels Nuclear in August, 1982. The well has a piston pump installed at the 480 foot level. The source of this water appears to be the saturated zone existing in the Toroweap limestone. The well produces approximately 2 gpm on an intermittant basis, and presently supplies a stock watering tank. The well has the registration number 55-503919.

Hunt/Hermit 503919 well is ≈1 mile NNE from Hermit Mine and perched water at mine site was encountered during exploratory drilling.

Hunt Well is 660' deep and the depth to water is 370' bls within the Kaibab Limestone

Depth to the top of the perched aquifer at mine site is in the Toroweap at 903' bls (Hermit Mine shaft closure, 1990)

Upon commencement of site preparation and shaft sinking operations, use of the well will be discontinued, the stock watering tank removed and the well capped and abandoned.

b. LIST LATITUDE/LONGITUDE OF ALL DISPOSAL LOCATIONS INDICATED ON THE ATTACHED MAP:

LATITUDE: 112° 45' 04" N

LONGITUDE: 36° 41' 23" W

3. a. TYPE OF FACILITY(s): Underground uranium mine

b. NATURE OF ACTIVITY CONDUCTED AT FACILITY(s):

Production of uranium ore from the underground mine.

c. DESCRIBE EXISTING GROUND WATER USE(s) OF THE RECEIVING AQUIFER(s):

Based upon extensive drilling and interpretation of geologic log information, two locally saturated zones are thought to exist between the ground surface and the base of mine workings. The Redwall-Mauv Formation is approximately 1,000 feet below the lowest extent of mine workings and is the only known regional aquifer in the vicinity of the proposed mine workings. Refer to Section 3.3.2 of the Dames & Moore "Ground-Water Conditions" report for further details.

A water supply well will be completed at the time surface site preparation commences. The water supply well to be drilled at the Hermit site has been assigned the registration number of 55-517832. The well will be constructed in the following manner: the surface casing will consist of twenty-two feet of 11 3/4 inch steel casing grouted in place in a 14 3/4 inch diameter hole. A 10 5/8 inch bit will then be used to deepen the hole to a depth of 975 feet or 40 feet into the Hermit shale. This portion of the hole will be cased with 976 feet of 8 5/8 inch steel casing. A 7 7/8 inch bit will then be used to deepen the hole to an estimated total depth of 2,800 feet, or approximately 100 feet into the Redwall limestone aquifer. The water production anticipated from this aquifer is expected to range from 5 to 15 gallons per minute. The formations and their respective thicknesses, which will be penetrated by the well are, in descending order: Moenkopi-260 feet, Kaibab Limestone Formation-342 feet, Toroweap Formation-311 feet, Coconino Sandstone-29 feet, Hermit Shale-650 feet, Supai Group-1,100 feet and Redwall Limestone-100 feet.

d. LIST APPLICABLE U. S. DEPARTMENT OF COMMERCE STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODES FOR ABOVE ACTIVITIES:

Division B 1094

4. DATE FACILITY BEGAN/WILL BEGIN OPERATING: June, 1987

Site work is proposed to commence in June of 1987. Shaft sinking will commence in October, 1987. Ground water is anticipated to be encountered March 1, 1988.

5. EXPECTED FACILITY(s) OPERATIONAL LIFETIME: Through 1997

6. LIST ANY OTHER ENVIRONMENTAL PERMITS ISSUED TO THE FACILITY(s) (I.E. AIR QUALITY PERMIT, NPDES PERMIT, HAZARDOUS WASTE PERMIT)

Request for Approval to Construct an Underground Uranium Mine will be made to the U. S. Environmental Protection Agency (EPA) pursuant to 40 CFR Part 61.

7. a. DESCRIBE DISPOSAL ACTIVITIES AT THE FACILITY(s):

Mine water and surface runoff from the operations area will be collected in lined surface impoundments. Refer to the attached "Plan of Operations", February, 1987 for a more detailed description of activities through the life of mine.

b. DESCRIBE ANY CONTROL MEASURES AND TREATMENT PROCESSES DESIGNED AND OPERATED TO PROTECT GROUND-WATER QUALITY FROM EFFECTS OF THE DISPOSAL:

The surface impoundments will be lined with 36 mil hypolon. The impoundments will be designed to hold the volume of runoff from the operations resulting from at least the 100-year/24-hour event, water pumped from the mine and a five-year storage volume for sediment. Refer to the attached Dames & Moore "Hydrologic Evaluations for the Proposed Hermit Uranium Mine", February 1987.

A water supply well will be completed at the time surface site preparation commences. This well will be completed in the Redwall-Mauv limestone. The Redwall-Mauv is approximately 1,000 feet below the lowest extent of mine workings and is the only known regional aquifer in the vicinity of the proposed mine workings.

c. NOTE OF DEPTH TO GROUND WATER:

DATE OF MEASUREMENT:

The stock watering well previously mentioned in Section 2a above was completed by Energy Fuels Nuclear as an exploration borehole on August 5, 1982. The borehole has a total depth of 690 feet. The borehole penetrates the Moenkopi, Kaibab and Toroweap Formations and is located outside the breccia pipe. Based upon drill log interpretation and observation during drilling, a local saturated zone apparently exists within the Toroweap at a depth of 602 to 680 feet below ground surface.

Static water level within the borehole, however, was approximately 360 feet below the surface at the time of borehole completion. The piston pump used for stock watering is installed at a depth of 480 feet below the surface.

A second saturated zone outside the breccia pipe apparently exists at the contact between the Coconino Sandstone and Hermit Shale. Static water levels within selected exploration boreholes in the Hermit were between 767 and 607 feet during investigations carried out in February of 1987 by Energy Fuels Nuclear.

d. ENTER IN APPENDIX A - PART I THE AMBIENT GROUND-WATER CONCENTRATIONS OF THE RECEIVING AQUIFER(s) FOR THOSE CONSTITUENTS LISTED THAT ARE CONTAINED IN THE DISPOSAL. INDICATE SOURCE OF DATA AND DATE OF SAMPLING FOR ALL VALUES LISTED.

The K/C aquifer is at the mine site. See Hermit Mine Shaft Closure Plan, 1990 and was just mentioned on previous pages

The Redwall-Mauv formation is the only known aquifer in the vicinity of the proposed mine. The water supply well has not yet been drilled so no analytical results are available. Refer to Section 3.4, Ground-Water Quality of the attached Dames & Moore "Ground-Water Conditions" report for a comparison of water quality in wells associated with other Energy Fuels operations on the Arizona Strip. The Hunt #5 well referenced in Table 2 of this report is the stock well discussed in Section 7 above.

Also attached as Exhibits #1 and #2 are water quality analysis from boreholes HU 536-034 and HU 536-031 located within the vicinity of the proposed Hermit mine.

At what depth?

HU 536-024 is located inside the breccia pipe (object of mining) and HU 536-031 is located outside the breccia pipe. It should be noted that the water quality within the pipe varies significantly from the water quality outside the pipe. Ground-water samples were collected on February 12, 1987 and February 24, 1987 respectively, and were sampled and preserved according to appropriate EPA guidance.

8. a. IDENTIFY THE TYPE(s) OF WASTE(s) GENERATED BY EACH PROCESS WITHIN THE FACILITY. BE AS DESCRIPTIVE AS POSSIBLE WITHOUT LISTING SPECIFIC CONSTITUENTS:

No discharge to surface or ground water will occur. Water will be intermittently pumped from underground workings to one or more lined surface impoundments, where it will be allowed to evaporate or be reused in connection with mining activities. The water will consist of unaltered ground water and surface runoff. No chemical processing of ore will occur on-site.

b. CHECK OF LIST IN APPENDIX A - PART II OF THE SPECIFIC POLLUTANTS DISPOSED BY THE FACILITY. INCLUDE THOSE DISPOSED MATERIALS THAT ARE LISTED IN TABLES I AND II OF THIS DOCUMENT IN TITLE 40 CODE OF FEDERAL REGULATIONS PART 261, OR ANY OTHER CONSTITUENT CONTAINED IN THE DISPOSED WASTE STREAM.

N/A - Unaltered ground water containing some suspended material.

c. ENTER IN APPENDIX A - PART II THE MAXIMUM DISPOSAL CONCENTRATION OF THOSE CONSTITUENTS YOU CHECKED OR LISTED, AS REQUIRED BY 8b. INDICATE THE DATE OF SAMPLING IN PARENTHESIS NEXT TO THE SAMPLE VALUE AND THE SOURCE OF THE DATA AT THE BOTTOM OF PAGE THREE IN APPENDIX A.

N/A - Unaltered ground water containing some suspended material.

d. ESTIMATE THE DISPOSAL SCHEDULE INCLUDING THE ANNUAL AVERAGE IN HOURS PER DAY, DAYS PER YEAR, AND THE DISPOSAL PERIODS IF THE DISPOSAL IS SEASONAL.

HOURS/DAY: No discharge

DAYS/YEAR: N/A

SEASONAL DISTRIBUTION OF DISPOSAL: N/A

e. ESTIMATE THE FLOW RATE(s) OF THE DISPOSAL (I.E. MINIMUM, AVERAGE, AND MAXIMUM DAILY FLOW; MEAN ANNUAL FLOW; OR MEAN, MINIMUM, AND MAXIMUM FLOW BY SEASON IF DISPOSAL IS PERIODIC; OR BY WHATEVER OTHER UNITS APPROPRIATE TO THE TYPE OF DISPOSAL:

N/A

9. DESCRIBE ANY EXISTING GROUND-WATER QUALITY MONITORING PROGRAM(s) (ATTACHED SUPPORTING TECHNICAL REPORTS IF AVAILABLE):

There is no ongoing monitoring program. Ambient water quality analysis for two boreholes are attached. Water quality for the existing stock well located on-site is presented in the Dames & Moore "Ground Water Conditions" report as Hunt #5, along with a discussion of ground-water quality.

10. INCLUDE ANY OTHER DATA OR INFORMATION WHICH, IN THE JUDGMENT OF THE OWNER/OPERATOR, DEMONSTRATES THAT THE FACILITY QUALIFIES FOR A GROUND-WATER QUALITY PROTECTION PERMIT BASED ON COMPLIANCE WITH THE CRITERIA LISTED IN 49-20-208.A. USE ATTACHMENTS IF APPLICABLE (I.E. DEPTH TO GROUND WATER, GEOLOGY AT THE SITE).

11. CERTIFICATION:

"I CERTIFY THAT UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED IN THIS DOCUMENT AND ALL ATTACHMENTS AND THAT, BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THAT THE INFORMATION IS TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT."

MURIL D. VINCELETTE
Printed Name of Applicant

VICE PRESIDENT, OPERATIONS
Title

JUNE 10, 1987
Date Application Signed

M D Vincelette
Signature of Applicant



ADHS/BWWQM-218 (1/84)
Revised 7/84

PLAN OF OPERATIONS

HERMIT PROJECT

FEBRUARY, 1987

#100299

Energy Fuels Nuclear, Inc.
Executive Offices
One Tabor Center
Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202

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PLAN OF OPERATIONS

HERMIT PROJECT

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I. INTRODUCTION

The Hermit Project, for which this Plan of Operations was prepared, will be conducted on unpatented, lode mining claims owned by Energy Fuels, Ltd. The claims are located in Section 17, Township 39 North, Range 4 West, Gila and Salt River Meridian, Mohave County, Arizona. The site is approximately twenty-two (22) miles south-southwest of Fredonia, Arizona.

Energy Fuels Nuclear, Inc. ("EFN") submits this Plan of Operations for approval pursuant to the requirements of 43 C.F.R. §3809, et seq.

The name and address of the operator is: Energy Fuels Nuclear, Inc., One Tabor Center, Suite 2500, 1200 Seventeenth Street, Denver, Colorado 80202, telephone number (303)623-8317. The person who will be in charge of the Operations is: Roger B. Smith, Manager of Operations, Energy Fuels Nuclear, Inc., P. O. Box 36, Fredonia, Arizona 86022, telephone number (602)643-7321. The record owner is: Energy Fuels, Ltd., One Tabor Center, Suite 2500, 1200 Seventeenth Street, Denver, Colorado 80202, telephone number (303)623-8317.

The objective of this Project is to recover, by underground mining methods, a uranium ore deposit occurring within the Project Area. The discovery of the uranium ore body was made during an exploratory drilling program undertaken by EFN pursuant to a previously approved Plan of Operations. Based upon surface drilling conducted during the summer and fall of 1986 and subsequent evaluation and analysis, a commercial uranium ore body was determined to exist within the Project Area.

The development and mining of the Hermit Deposit will be conducted in two phases. The first phase will involve initial site preparation and shaft sinking activities, followed by an underground evaluation, development and production phase during

which ore recovery will occur. The initial underground evaluation will be conducted by sinking a shaft approximately 1,100 feet below the surface adjacent to the deposit and then extending horizontally into the ore body. Once access to the ore body has been established in phase one, extensive underground drilling and sampling will be done to fully define the extent and grade of the deposit.

During the site preparation and shaft sinking phase, surface facilities will be limited to those necessary to facilitate shaft sinking activities. Because of the proximity of the Project Area to an existing power line, this phase of activities will be supported by permanent electric power. During initial site preparation and shaft sinking activities, no uranium ore will be encountered. In addition, until completion of the underground evaluation and development activities, it is anticipated that ore production will not exceed a few thousand tons -- an amount sufficient for a complete sampling of the full ore body. Moreover, it is not anticipated that any uranium ore will be encountered until sometime during the second year of activities at the Project Area. Prior to this time, site preparation activities on the surface and shaft sinking activities will not involve the movement or storage of uranium ore on the surface. During the first phase, EFN proposes to relocate approximately 1.2 miles of road as shown on Plate 2.

Once significant ore production activities begin in the second phase of activities, approximately three (3) years after site preparation activities begin, the surface facilities will be expanded as necessary to accommodate the needs of the expanded work force necessary to complete underground development of the ore body and the full mining and extraction of the mineral reserve. During this development and mining phase further upgrading of the relocated access road is planned so that ore haulage can be safely undertaken.

EFN is active in the natural resource industry, with major holdings in uranium. The Company built and is part owner of a 2,000 ton per day uranium processing facility located near Blanding, Utah. As a uranium producer, EFN is currently engaged in various phases of site preparation, shaft sinking, underground development, mining, or reclamation activities at six (6) mines in northern Arizona north of the Grand Canyon (See: Plate 1). It has recently closed or is in the final stages of mining at the three (3) Hack Canyon Mines (approximately eight miles south of the Hermit Project) where mining has been successfully and profitably done since 1981. Mining at all of the three (3) Hack Canyon Mines will have been completed by the end of the first quarter of 1987, at which time site reclamation will begin.

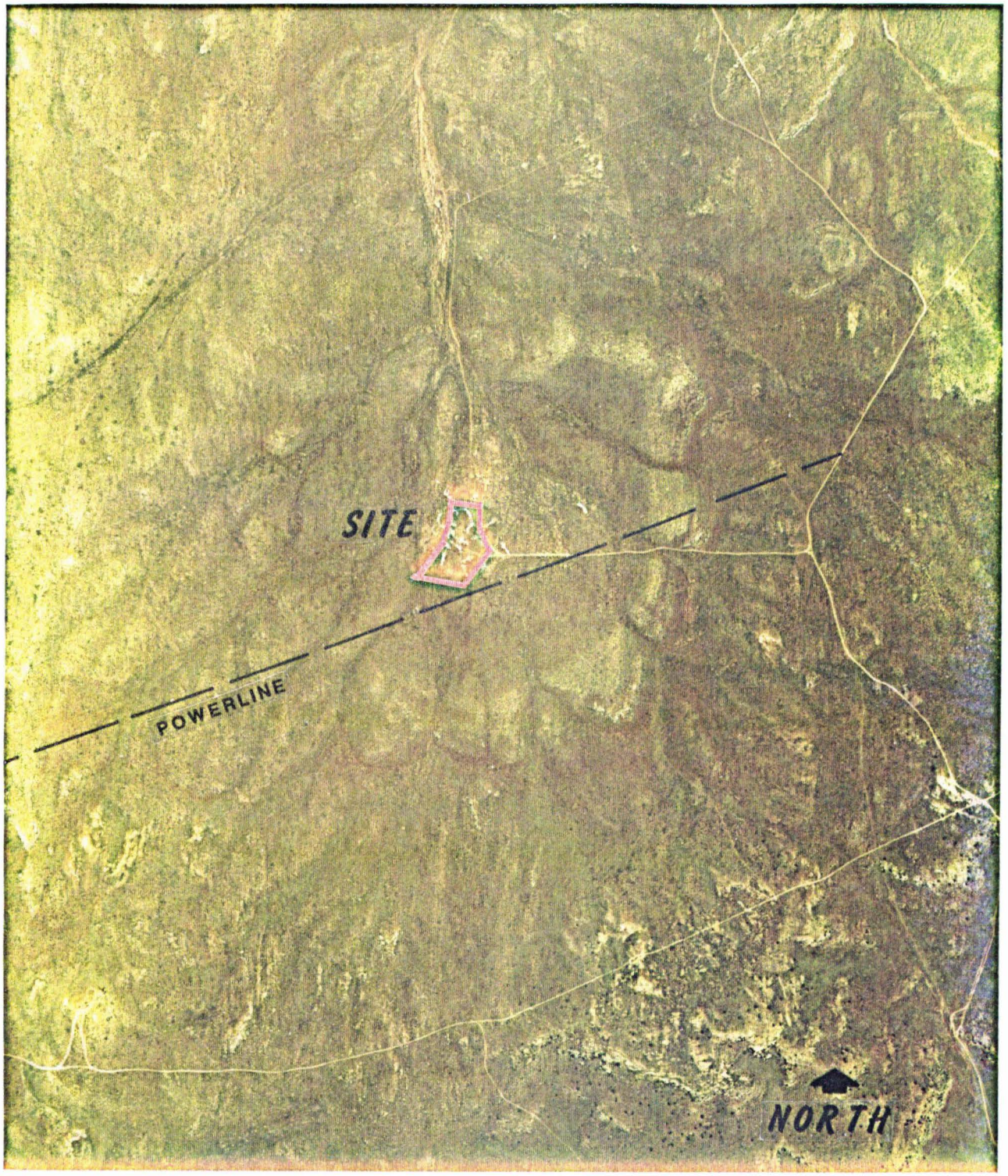
At the Pigeon Mine (approximately 12.5 miles northeast of the Hermit Project) site preparation and shaft sinking began in 1982, with underground drilling, evaluation and development activities continuing until mid-1984 when full mining began. Mining activities at the Pigeon Mine are expected to continue until 1990 (the time when commercial ore production at the Hermit Project is expected to commence) when site reclamation will commence.

At the Kanab North Mine (approximately 6 miles east of the Hermit Project) site preparation and shaft sinking activities did not begin until 1985. At the present time, EFN has completed its shaft sinking activities at the Kanab North Mine and is proceeding with its underground drilling, evaluation and development work. Significant ore production from the Kanab North Mine is not anticipated until 1988 or 1989.

Finally, at the Pinenut Mine (approximately 13.25 miles south of the Hermit Project) site preparation and shaft sinking activities began in mid-1986. At present, site preparation for the first phase of activities has been completed and shaft sinking activities have just begun. Significant ore production from the Pinenut Mine is not expected until 1989 or 1990.



FIGURE 1. HERMIT PROJECT - REGIONAL VIEW. The project is located at the red dot. The Mount Trumball Road is in the upper left corner. Note east flowing drainage going into Gramma Canyon in the lower right photo corner. All north trending drainage flows into Bulrush Canyon. Scale: 1" = 1/3 mile. (Photo taken August 30, 1968).



Moenkopi formation is fluvial deposits - how is there limestone? How does limestone form in a ring?

FIGURE 2. HERMIT PROJECT - LOCAL VIEW. Project area is at photo center. The white ring around the project is a limestone in the lower Moenkopi formation. The trail crossing photo bottom is near the watershed divide. Scale: 1" = about 1,000 feet. (Photo taken March 24, 1984).

It is apparent from the above description of the status of activities at the other locations where EFN is operating that by the time the Hermit Project is sufficiently developed to enable EFN to produce significant quantities of ore from the Project, ore production from the three (3) Hack Canyon Mines and the Pigeon Deposit will have been completed.

Access to the Project Area from Fredonia, Arizona is gained by traveling southwest on State Highway 389 eight (8) miles to the Mount Trumbull Road. After traveling eleven (11) miles south on Mount Trumbull Road, a southeast side road is taken 1.2 miles to the Project Area (See Plate 1).

The mining claims making up the Project Area consist of six (6) unpatented lode mining claims, identified by the following Bureau of Land Management ("BLM") serial numbers and claim names:

Claim Name	BLM Number
Hunt 533-537	A MC 150856 - 150861

Upon approval of this Plan of Operations by the BLM, EFN intends to proceed as quickly as practicable to implement the first phase of activities at the Project Area. In this regard, because the required surface facilities during the first phase of activities are minimal, the construction and site preparation activities (specifically the initial surface facilities required for shaft sinking) are expected to be in place within six months after the Plan of Operations is approved.

II. GENERAL DESCRIPTION OF PROJECT AREA

Topographically, the Project Area is on the Kanab Plateau within the Grand Canyon section of the Colorado Plateau physiographic province. The Project Area is located on flat ground in a topographically indistinct area. Specifically, as can be seen

from Figures 1 and 2, relief in and around the Project Area is minor, with elevation extremes of approximately eighty (80) feet within a one mile radius.

The general vegetative cover of the Project Area is grasses and sagebrush. Bare rock and soil are exposed over 50% of the area and there is no vegetation over three feet in height. There are no known threatened or endangered plant species in the area.

Because of the dominance of big sagebrush throughout the Project Area, it may be characterized as being of poor quality for livestock grazing or wildlife browsing. Although sagebrush will be eaten by both cattle and wildlife as a last resort, the vegetation which dominates the Project Area would not be expected to support a large number of wildlife species. In order to verify this expectation, EFN caused a systematic wildlife survey of the Project Area to be conducted. During this survey, no big game were observed, and very minimal signs of wildlife existed. Based upon the wildlife survey of the Project Area, the consultant confirmed that wildlife utilization of the area is minimal due to the types of vegetation in the area and a natural lack of surface water resources. No unique, threatened or endangered wildlife species are known to utilize the Project Area.

An archaeological survey of the Project Area and surrounding forty (40) acre area is on file with the BLM. This survey confirmed that no sites of cultural significance exist within the Project Area.

The general project region is classified as a semi-arid continental climate. It is typified by cool winters, warm summers and light precipitation. Winter temperatures drop below freezing at night, while summer temperatures rise above 90 degrees Fahrenheit. Annual precipitation in the area averages less than fifteen inches and the summer and winter months are typically the wettest. Winter precipitation is primarily in the

form of snow. Summer precipitation is usually the result of thunderstorm activities, which at times can be heavy.

Long term wind data is limited in the vicinity of the Project Area. However, to better define the wind patterns of the Arizona Strip, in 1983 Energy Fuels retained the services of Fox Consultants, Inc., an independent consultant, to measure wind patterns of the area. As a result, a one year data set was collected from a meteorological station located near Sunshine Point at an elevation of 5330 feet MSL and a distance of approximately eight miles south of the Project Area. Wind data at this station were collected from March, 1983 to March, 1984 and, because of the similarities in topography and elevation and the close proximity of the meteorological station to the Project Area, the resultant meteorological data are very representative of the Project Area. These data show that the prevailing wind direction at the Project Area is from the south-southwest, with south-southeast through southwest winds clearly dominating the wind patterns of the area. (Nearly 40% of all winds blew from the south-southeast through southwest sectors). On the other hand, easterly component winds are the least frequently occurring at the Project Area, with east-southeast occurring less than 1.0% of the time.

Wind speeds averaged 3.4 m/sec (7.6 mph) throughout the one year monitoring period, with higher average wind speeds more often associated with southerly component winds. However, high wind speeds were not common, as wind speeds in excess of 11 m/sec (24.6 mph) occurred only 0.32% of the time.

The entire Project Area is covered by the flat-lying, lower Triassic Moenkopi formation. This unit is a dark red-chocolate brown with intervals of shale, siltstone and fine-grained sandstone. Less than one hundred feet below the surface is the Kaibab formation, a marine deposited limestone that contains minor zones of shale and sandstone. The Kaibab and the Toroweap (a similar formation) extend to a depth of about nine hundred

feet. The resistance of these two limestone formations to erosion accounts for the extensive regional plateau.

Under the Toroweap formation in descending order are the Coconino formation, a nearly thirty foot thick, massive, tan sandstone, and the Hermit Shale formation. The Hermit formation is mainly a fine-grained sand or silt stone with local shale zones. Both the red color and the few fossils found in this unit indicate that it was once a semi-arid coastal plain. Both the Coconino and upper Hermit formations host the known uranium mineralization. Below the Hermit formation is the Supai formation.

Uranium mineralization in the Project Area occurs in a breccia pipe structure that cuts vertically through the flat-lying sedimentary rocks. Cavities formed millions of years ago by water dissolving the deeper Redwall Limestone created space into which the overlying rock collapsed. The collapsed zone worked its way up many hundreds of feet in the form of a cylinder or narrow cone. Geochemical changes to the brecciated zone recemented the broken rock and deposited uranium and other minerals. The brecciated zone is now slightly more dense and less porous than the surrounding rock.

III. PLANNED OPERATIONS

During the next several years, EFN plans to develop and mine the uranium deposit located in the Project Area by underground mining methods in two distinct phases of operations.

Based upon its experience with similar deposits, EFN expects its site preparation, shaft sinking, underground drilling and development, and mining and reclamation activities to be completed in approximately ten (10) years. Access to the deposit will be by a conventional, two and one-half compartment, vertical shaft located immediately northwest of the deposit. The shaft

will be excavated to a depth of approximately 1,100 feet below the surface. As the vertical shaft is sunk, horizontal workings will be driven at various levels toward the deposit. Thereafter, two to four underground drilling chambers will be excavated in or near the deposit. From these chambers, underground drilling will be undertaken to further define the full extent of the deposit. Portions of the workings within the deposit and the underground drilling will provide EFN with adequate information to determine the most efficient mining sequence for recovery of the mineral reserve. The proposed shaft location, surface facilities, shaft and waste rock disposal area are identified on Plate 2.

During site preparation, shaft sinking and underground drilling and evaluation, employment will range from 12 to 22 personnel. Shaft sinking generally is conducted on a three-shift, seven day per week schedule. A two-shift, five day per week schedule is probable during underground drilling and development activities. During this phase, a majority of the employees will be skilled shaft miners, transferred from nearby mines presently operated by EFN or contractors hired locally. Little or no influx of new personnel to the area is expected.

Once the initial underground drilling program has satisfactorily confirmed the extent and dimensions of the ore deposit, horizontal workings will then be driven from the lowest portion of the shaft, beneath the deposit to a point just outside the farthest extent of the ore reserve. From this point, an eight foot diameter, vertical ventilation shaft will be upreamed to the surface utilizing a pilot hole to intersect the lowest workings. This second (ventilation) shaft will exhaust air, thereby creating adequate airflow throughout the mine workings, and, in addition, providing a second exit or escapeway from the mine in the event of an emergency.

Raise or incline workings within the mine will connect the various levels within or very near the deposit. At various

elevations from these levels, sublevel workings will be driven to extract ore from the deposit. The broken ore will be dropped down raises, designed for such use, to drawpoints on the lowest level. The ore will then be hauled to the shaft, at which point it will be transferred to skips in the shaft and hoisted to the surface. Barren waste rock generated during shaft sinking, development and mining will be removed and disposed of on the surface in the waste disposal areas, to the extent that such material cannot be utilized for road maintenance or construction of the mine yard. Ore will be stockpiled on the surface near the shaft until shipment to the Blanding mill takes place.

After development work is completed (approximately three years after start-up), the mine will be operated at an average production rate of 300 tons per day for approximately five years. It is hoped that planned underground drilling will increase the tonnage to be mined and, consequently, extend the operation's life by a few years. However, experience to date at other operations suggests that a production phase significantly longer than five (5) years is unlikely.

Employment during the first few years of underground development will range from 15 to 30 personnel. As production capacity grows, employment could reach approximately 40 personnel at the 300 ton-per-day rate, working two shifts per day.

Most employees are expected to be drawn from existing residents of the area. Moreover, it is hoped that the work force will consist of employees currently working at the Hack Canyon and Pigeon Mines. Since these mines will have ceased operations by the time the production phase of the Hermit Project begins, EFN would plan appropriate transfers, if timing permits. EFN will provide and operate buses to transport employees to and from the Project Area. Driving of individual vehicles is discouraged. Management and technical staff support will be based at the Fredonia Mine Operations office.

IV. AREAS TO BE DISTURBED

There are two specific areas that will be temporarily used or disturbed during the Project life: (1) The Area of Operations with surface plant and rock disposal area (23.6 acres); and (2) 1.2 miles of access road (5.0 acres). The Area of Operations where all activities will take place, together with planned surface facilities, are shown on Plates 2 & 3. In designing the Plan of Operations, EFN has minimized the size of the Area of Operations as much as practicable to ensure adequate working area while minimizing disturbance. The locations of the shafts, office, hoist house, main building, waste rock storage area and ore stockpiles will all be generally located during each phase as shown on Plates 2 & 3. Of course, further engineering and unexpected problems encountered during construction could cause the actual layout to differ in minor detail from that shown on Plates 2 & 3. In any event, the surface impacts from the proposed operations will be unaffected by any necessary minor relocations within the Area of Operations.

Even with a complete lack of trees or shrubs in the area, the project is not visible from Mount Trumbull Road. The site is in a topographic low and several minor ridges separate it from the main road.

During the first two to three years of the Project or during the underground evaluation phase, only the eastern half or 15 acre portion of the Area of Operations will be utilized. This initial yard is within the larger 23.6 acre Area of Operations to be occupied during the production phase. During the underground evaluation phase, only the shaft and sinking hoist area will be graded to a final yard elevation.

A water source of a few gallons per minute is needed for underground drilling and sanitation during the first phase of activities. Consequently, a water well will be drilled on the

southwest edge of the Area of Operations to a depth of 2,000 to 2,500 feet. Tankage to hold water will be located near the site of the water well. In the area shown on Plate 2 at least two house trailers will be located during phase one which will serve as temporary lodging for the mine staff and a security guard as may be needed during phase one. No full-time resident other than a security guard is proposed.

Prior to construction of the mine yard, available topsoil from the initial areas to be disturbed will be removed and stored at the eastern edge of the Area of Operations (See: Plate 2).

In addition, during phase two a second topsoil storage area will be created at the western edge of the Area of Operations (See: Plate 3). These locations will assure that topsoil will not be disturbed during mining activities. In addition, after construction of the water diversion facilities discussed below, the topsoil stockpiles will be protected from erosion due to surface run-off. The size and dimensions of the topsoil stockpiles will increase at the beginning of the production phase when additional topsoil is removed and stored prior to construction of the final mine yard.

During phase one, EFN proposes to relocate approximately 1.2 miles of access road as shown on Plate 2 so that access to the Project Area of equipment and personnel can be achieved with safety and minimal environmental impact. In order to avoid the addition of 1.2 miles of new roads to the BLM system, EFN proposes to reclaim fully the existing access road to the Project Area to BLM standards during phase one of activities, provided that such reclamation is acceptable to the BLM. In addition, upon completion of mining activities at the Project Area, the relocated access road would also be fully reclaimed unless the BLM requests that such access road be left in tact as part of the BLM system.

During the first phase of activities, a temporary hoist to excavate the shaft will be located on a 10 foot X 15 foot concrete slab located approximately 125 feet west of the shaft. A wooden framed building will surround the temporary sinking hoist. The necessary generators, air compressors, semi-trailers for shop, warehousing, office and showers will be located to the southeast of the temporary hoist building. Immediately south of the shaft, a septic field will be located to handle sewage from the showers and trailers located with the Area of Operations.

During initial development activities at the beginning of phase two only minimal ore is expected to be generated incidental to the underground evaluation and development activities. Specifically, EFN estimates that no more than a few thousand tons of ore will be generated during the underground evaluation and development phase of activities. This material will be stored at the location shown on Plate 3 until shipped to the Blanding mill for bulk sampling and amenability testing.

In order to ensure that no surface run-off from outside of the Area of Operations is allowed to enter, EFN will construct water diversion facilities on both the east, south and west perimeters of the Area of Operations as shown on Plates 2 & 3. Prior to the design of these surface water diversion facilities, it was necessary for EFN to analyze the watersheds involved and the potential of the area to experience severe storm events. Consequently, EFN retained the services of Dames & Moore, consulting hydrologists, to evaluate the surface run-off issues and to advise EFN regarding proper design, location and capacities for the diversion facilities. The surface water diversion facilities which EFN will construct will conform with the recommendations of Dames & Moore and will ensure that these facilities are capable of diverting around the areas of disturbance the surface run-off resulting from at least a 100 year storm event. Importantly, this significant margin of safety will be achieved while making maximum use of the existing natural channels existing in the

Project Area. The planned diversion facilities will be constructed during the first phase of activities and will be maintained throughout the life of the Project.

All rainfall which falls within the Area of Operations will be directed to and held in the surface water holding/evaporation pond shown in Plates 2 & 3. This pond will be lined with an artificial impervious material to insure that leakage does not occur. It will be constructed during phase one and will be sized to hold all water which may be encountered during mining activities as well as the surface drainage within the disturbed areas resulting from a 100-year 24-hour event.

After the deposit has been fully evaluated, as part of the next phase of activities the nature and extent of the surface facilities will be expanded as shown on Plate 3. Moreover, during this phase of activities the area of disturbance will be expanded to enable the efficient extraction of the ore reserve -- including construction of ore stockpile areas and an additional topsoil stockpile. Finally, as these activities proceed, some additional access road upgrading activities will be necessary to accommodate the ore haulage needs of the mine -- estimated to average 12 truck loads per day once full ore production is achieved.

Of course, prior to beginning the surface expansion activities, available topsoil within the additional disturbed areas will be collected and stored for use in final reclamation in the identified topsoil stockpile area.

Barren waste rock from excavation of the underground workings will either be used to build the relocated access roads, mine yard and stockpile areas to the required grade, or any excess will be disposed of in the area shown on Plate 3. This waste disposal area has the capacity to hold the expected barren waste

rock to be generated without noticeable change to the original topographic appearance.

The largest and only major building in the surface plant will be the "main building" located as shown on Plate 3. This building will house the permanent hoist, air compressors, standby electric generator, change house, shop warehouse and emergency medical facilities.

South of the main building, various supplies needed during the production phase will be stockpiled. Tankage for storage of gasoline and diesel fuel will be located as shown in Plates 2 & 3 in the area to the northeast of the main building.

Once the surface facilities needed during the production phase of activities have been installed, a six foot chain link security fence with lockable gates will be erected to enclose the Project Area as noted on Plate 3. The mine-use area will be posted with "No Trespassing" signs. The gates in the security fence will be closed and locked during periods of inactivity at the mine site.

V. MEASURES TO LIMIT DISTURBANCE

This Plan of Operations is designed to minimize disturbances to the environment and to provide for complete reclamation of the surface after completion of the mining activities to the standards required by law. The areas proposed to be disturbed are as compact as practicable with surface facilities and stockpile and disposal areas clustered together where feasible.

In the design of this Plan of Operations, EFN recognized that one of the important natural environmental issues at the site is proper handling of surface water run-off from adjacent watersheds. To address this issue, and to insure the integrity of the Area of Operations during activities, flood control measures have

been built into the Plan of Operations consistent with the recommendations of an independent surface water hydrologist who evaluated the area. As designed, surface water cannot enter the Area of Operations from any direction. In addition, rainfall within the yard will be retained within the Area of Operations because of its internal drainage. In addition, the designed water holding/evaporation pond will be sized with sufficient capacity to retain the surface run-off which would be expected to fall within the disturbed area as a result of a 100-year, 24-hour storm event as well as any excess water encountered during mining activities which cannot otherwise be utilized in connection with ongoing activities.

Diversion channels to direct surface run-off around the Area of Operations will be constructed as one of the first activities. The small watersheds above the Area of Operations, approximately 200 acres, will flow into the diversion channels rather than into the Area of Operations.

The southwestern portion of the mine yard will be used to stockpile ore prior to shipment to a mill for processing. Prior to stockpiling ore grade material in the locations shown on Plate 3, EFN will construct an ore pad upon which all ore grade material will be stockpiled pending removal from the Project Area. Each ore pad will be at least one foot thick and shall be constructed utilizing a mixture of limestone and shale produced from the underground excavation at the Project Area. Experience at other facilities has confirmed that ore pads of this type are effective in preventing the movement of any mineral values into the soils below the ore pad during periods of ore storage.

All material containing more than 0.03% U_3O_8 will be temporarily stockpiled at the location shown on Plate 3. Approximately 65,000 tons of such low grade material will be produced during mining activities. If market prices increase, nearly all of this material will be shipped to a mill for processing before the

close of mining activities. If any of this low grade material remains within the Project Area at the close of activities, prior to final reclamation, EFN will haul it from the site or dispose of it underground in the mined-out workings.

EFN will construct and maintain the access road from the Project Area to the Mount Trumbull Road in conformance with BLM specifications. Ore haulage from the site will be by independent truck contractors using 25-ton capacity trucks which comply with Arizona Highway Department of Transportation requirements. To prevent loss of material from wind erosion and rough roads, each load will be covered with a tarpaulin lapping over the side about a foot and secured every few feet around the truck bed. In the event of a truck accident, EFN will take immediate aggressive action to clean up any spilled material.

VI. MEASURES TO BE TAKEN DURING A PERIOD OF NON-OPERATION

EFN intends to operate the Hermit Project until all economic ore reserves are exhausted. The federal regulations which require submittal of this Plan of Operations call for a statement of measures to be taken in the event of an "extended period of non-operation before mining is completed." While there is no definitive plan for a shutdown before exhaustion of the mineral reserve, this occurrence must be regarded as a possibility.

Two different types of scenarios would occur depending upon the anticipated length of non-operation. A short shutdown of a few months to a year would require only limited action. In this case, a few employees would be kept at the mine site for repair and maintenance work and a watchman would reside at the mine site. All inventory items that may deteriorate in a year's time, such as explosives, oil, gas and first-aid supplies, would be used or removed from the Project Area. Hardware, such as nuts,

nails and pipe fittings, would be secured in place. All equipment would be checked and most of it stored in the shop building or in the mine workings. The limited amount of equipment that could be used at other EFN operations would be removed from the site. All stockpiles above economic grade would be shipped to a mill for processing. There would likely be some stockpile of low grade ore which would be maintained at the mine site during a shutdown. Ventilation fans, electric lines and transformers would be left in place. Steel gates on the mine shaft would be closed and locked.

In the event of non-operation for more than a year, a different procedure would be followed. Nearly all mobile equipment and a portion of the fixed equipment would be removed from the Project Area. Fans would be removed and the ventilation shaft capped with perforated steel plates welded in place to allow natural ventilation but to prevent access to the workings. The buildings, headframe and hoist would be left in place but secured and maintained in the same manner as a short term closure.

VII. MEASURES TO RECLAIM AT THE END OF THE OPERATIONS

At the conclusion of mining activities, EFN will disassemble and remove the hoist/shop building and bury all concrete footings and concrete slab materials within the mine yard or backfill the material into the shaft. All facilities, materials, supplies and equipment will be removed. Low grade material will be removed from the site or backfilled into the mine shaft. The shaft entrance will be sealed to prevent entry by unauthorized members of the public, and the entire Area of Operations will be fully reclaimed as shown on Plate 4. Specifically, the following reclamation activities will be implemented at the end of mining activities:

(1) After the removal of all equipment, the shaft will be sealed in a manner approved by the appropriate regulatory agencies.

(2) All portions of the Area of Operations not previously reclaimed will be re-contoured and re-topsoiled. All remaining topsoil will be spread over the Area of Operations and contoured.

(3) All ground surface which has been disturbed will be drill seeded using a seed mixture approved by the BLM prior to application.

(4) The Area of Operations will be radiometrically surveyed and any material found which exceeds acceptable radiation standards will be either buried in the mine workings or removed from the site.

(5) The diversion channels built at the start of the Project will be kept in place so as to divert surface run-off around the area of reseeding until revegetation has been adequately established. Thereafter, if requested by the BLM, these channels will be re-contoured and seeded.

(6) Sediments accumulated in the holding pond, if any, will be scalped from the pond and either hauled from the Project Area or disposed of underground in the mined out workings.

(7) The potential usefulness of the water well will be evaluated as part of final site reclamation. If there is no other use for the well, it will be sealed and abandoned.

(8) The access road used for site access and haulage will be fully reclaimed unless the BLM requests that it be left in place as part of the regional road system under the jurisdiction of the BLM.

VIII. CONCLUSION

EFN, as operator of the Hermit Project, has prepared and submitted this Plan of Operations. The Plan was developed in accordance with existing regulations and pursuant to discussions with the BLM. In several areas such as archaeology, surface water, groundwater, radiation and wildlife, research and analysis was undertaken by independent consultants at the request of EFN to assist in the design of the surface facilities and to assess the potential impacts of the proposed activities. Copies of these various reports have or will be provided to the BLM under separate cover. In general, these reports establish that the potential impacts to the environment of the proposed activities at the Hermit Project are confined to the area immediately surrounding the Project Area.

EFN will provide additional information as required and will entertain a request for further discussion or on-site meetings. EFN believes that implementation of this Plan of Operations will ensure that the proposed activities are compatible with all existing characteristics of the area and that the Project Area is fully and completely reclaimed after completion of activities.

Arizona Republic Tues. July 14, 1987

21 seized in protest at mine

Uranium-ore trucks stalled 30 minutes

By MARK SHAFFER
Northern Arizona Bureau

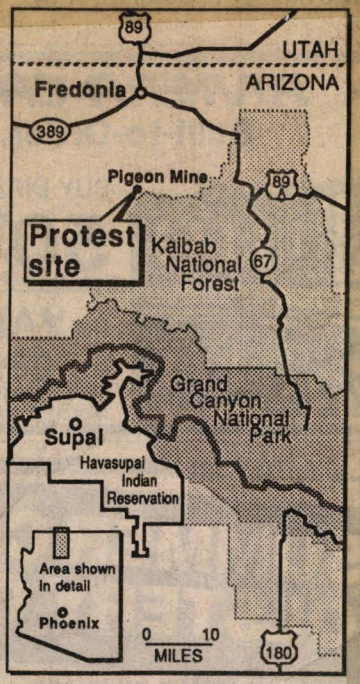
Twenty-one members of the environmental group Earth First! were arrested Monday after disrupting operations for two hours at a uranium mine on federal land north of the Grand Canyon.

The disturbances occurred at Pigeon Mine on the Arizona Strip, about 20 miles north of the Grand Canyon and just outside the Kaibab National Forest on Bureau of Land Management land. The mine is one of seven sites north of the canyon operated by Energy Fuels Nuclear Inc. of Denver.

Thirteen of the protesters, who scaled a 6-foot-high chain-link fence topped with barbed wire, were charged with trespassing. Eight others, dressed in animal costumes and radiation suits, were charged with obstruction of a roadway, said Lt. Bill Pribil, a spokesman for the Coconino County Sheriff's Department. All are misdemeanor charges, he added.

"Yeah, we arrested a raccoon, a bear and a skunk," Pribil said, adding that the protesters in costumes had prevented two uranium-ore trucks from leaving the mine for about 30 minutes.

All but one of the protesters refused to give their names in an initial appearance before Fredonia Justice of the Peace Tom Newell. They were transported by bus to Coconino County Jail in Flagstaff on Monday night. One man, identified as Jeff Hoffman of Tucson, pleaded innocent and was released on $685 bail, Newell said. An Aug. 13 trial date was set.



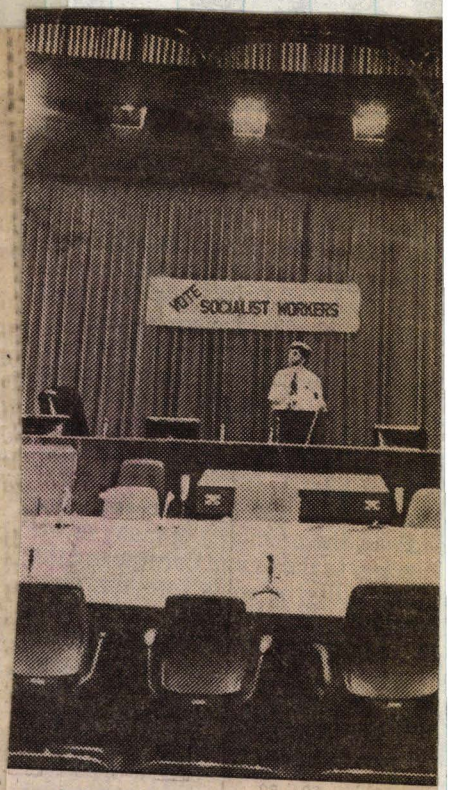
Republic

Roger Featherstone, an Earth First! spokesman, said protesters decided to not give their names because "they didn't mind spending the night in jail."

According to authorities and group members, about 90 Earth First! members, singing anti-uranium songs, marched to the mine gate about 10 a.m. where they were met by 12 officers from the Sheriff's Department, state Department of Public Safety and Energy Fuels' security personnel.

Eight protesters then scaled the fence and were arrested for

— *Protest, B2*



6, announces his candidacy for Ph
ppear to be deserted. The dozen or

Miguel S. Santiago 12/12/88

Summary of Monitoring Results
Hermit Mine Monitor Well

(mg/l)	4/28/88	6/28/88	9/27/88 (well)	9/27/88 (shaft)	12/22/88 (well)	12/22/88 (shaft)
Alcalinity as CaCO3	159	155	157	235	157	223
HCO3 as CaCO3	159	155	157	235	157	223
CO3 as CaCO3	<1	<1	<1	<1	<1	<1
NH4(N)	<.1		<.1	<.1	.1	.1
As	.013	.015	.020	.045	.006	.011
B			.38		.16	.19
Ba	.01	.02	.04	.02	.04	.06
Cd	<.005	.025	<.005	<.005	<.005	<.005
Ca	585	577	494	570	533	545
Cl	43	41	42.3	30.1	40.1	31.1
Cr	.10	.15	.13	.09	.01	.01
Condt. (umho/cm)	3430	3210	3340	3350	3440	3310
Cu	.01	.02	.02	.019	.04	.04
F	1.47	1.39	1.32	1.16	1.41	1.24
Fe	4.03	7.48	6.21	.62	7.33	0.92
Pb	<.02	0.15	<.02	<.02	~~<0.2~~ <0.02	<0.02
Mg	183	192	169	172	177	174
Mn	.06	.11	.09	.04	.10	.04
Hg	.0011	.0011	.0003	.0005	<.0002	.0006
Mo			.05		.01	.01
NO3(N)	.7	<.1	<.1		<1.0	<1.0

					12/22/88 (well)	(shaft)
pH (units)	8.02	6.54	7.2	7.2	~~7.70~~ 7.40	~~7.40~~ 7.36
PO4	<.1	<.01	<.1	<.1	<.1	<.1
K	25.3	24.4	19.4	25.1	21.6	32.3
Se	.009	.006	.037	.017	.012 ~~.012~~	.014 ~~.014~~
SiO2	13.6	12.8	11.0	10.3	12.6	9.6
Ag	.01	.02	.02	.02	<.01	<.01
Na	70.1	78.8	69.5	76.1	73.6	107
TDS	3500	3450	3430	3250	3430	3200
TSS	18		14	<4	9	<4
SO4	2230	2240	2080	2040	2220	~~2080~~
SO3			<2		<5	<5
Zn	<.005	.118	.070	.070	.136	.134
Alpha (pCi/l)	0+19	0+16	76+25	1300+100	12±18	1500±100
Beta "	31+12	27+10	38+11	490+20	30±10	370±20
Ra-226 "	3.5+0.7	2.6+0.6	0.4+0.2	150+10	2.1±0.5	162±4
Ra-228 "	0.0+0.7					
Th-230 "	0.0+0.3	0.7+0.7	0.4+0.4	1.2+0.8	0.6±0.6	0.1±0.5
Pb-210 "	0.5+0.9					
Po-210 "	0.8+0.5					
U(mg/l)	0.0025	0.0025	.0022	.0420	.0024	.0207

How is the Beta 31 & 27 but the Alpha 0?

2.5 ppm

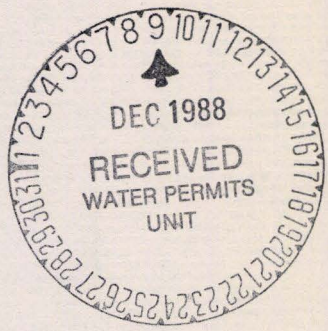
Barrington Labs did not have the facilities to measure concentrations below 5 ppb or to this precision

3rd Quarter 1988

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561



December 8, 1988

Mr. Miguel Santiago
Environmental Health Specialist
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine Groundwater Protection Permit
No. G-0035-08

Dear Mr. Santiago:

Enclosed please find Third Quarter analytical results from the Hermit Mine monitor well. The well was sampled on September 27, 1988 and sample analysis is identified as HR025. Also attached are analysis results taken from a water producing zone within the Hermit shaft sampled on August 22, 1988.

Same sample number, but shaft appears to be HR 023 not HR 025

Shaft water analysis is identified as Sample Identification Number HR025. Water was collected at a point approximately 908 feet below shaft collar elevation (3976 MSL) in a zone yielding an estimated 9 gpm. The water bearing zone is just above the contact between the Hermit shale and Coconino sandstone.

If you have questions concerning this matter, please contact me at our Denver office.

Sincerely,

William J. Almas
Environmental Coordinator

WJA:smm

Enclosures

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 8635 Client PO No.

Sample Type: water

Date Collected: Date Received: 8/23/88 Date Reported: 9/30/88

RESULTS OF ANALYSIS

Usually, the Alkalinity (carbonate) and the HCO3 (bicarbonate) are not the exact same value

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l	As Total mg/l
HR023 (Hermit Shaft)	235	235	<1	<0.1	0.045

Sample Identification	Ba Total mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance µmho/cm
HR023 (Hermit Shaft)	0.02	<0.005	570	30.1	0.09	3350

Sample Identification	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HR023 (Hermit Shaft)	0.019	1.16	0.62	<0.02	172	0.04	0.0005

Sample Identification	pH units	PO_4 mg/l	K Total mg/l	Se Total mg/l	SiO_2 Total mg/l	Ag Total mg/l	Na Total mg/l
HR023 (Hermit Shaft)	7.20	<0.1	25.1	0.017	10.3	0.02	76.1

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 8635

Sample Identification	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l	(Total) Gross Alpha pCi/liter ±Precision*	(Total) Gross Beta pCi/liter ±Precision*
HR023 (Hermit Shaft)	3250	<4	2040	0.079	1300 ± 100	490 ± 20

Sample Identification	Ra-226 (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HR023 (Hermit Shaft)	150 ± 10	1.2 ± 0.8	0.0420

42 ppb

1,300 pCi/L ≈1,950 ppb

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
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(303) 277-1687

Energy Fuels Nuclear, Inc.
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Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 8635

QUALITY CONTROL DATA SHEET

Time Received: Date: 8/23/88 By: Gina Reichert Via: Federal Express

Sample Type: water
Sample Container Type: large cube

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
pH	1	150.1	0.01 units	3	J. Hageman	8/29/88
Chloride	1	325.3	0.2 mg/l	3	D. Hobbs	8/29/88
Alkalinity	1	310.1	0.5 mg/l	3	A. Knudson	8/30/88
Ammonia	1	350.1	0.1 mg/l	2	D. Hobbs	8/30/88
Fluoride	1	340.2	0.1 mg/l	3	A. Knudson	8/31/88
Mercury	1	245.1	0.2 µg/l	1	G. Gilleland	9/6/88
Barium	1	200.7	5 µg/l	1	D. Hidalgo	9/8/88
Cadmium	1	200.7	5 µg/l	1	D. Hidalgo	9/8/88
Calcium	1	200.7	10 µg/l	1	D. Hidalgo	9/8/88
Chromium	1	200.7	10 µg/l	1	D. Hidalgo	9/8/88
Copper	1	200.7	10 µg/l	1	D. Hidalgo	9/8/88
Iron	1	200.7	10 µg/l	1	D. Hidalgo	9/8/88
Lead	1	200.7	5 µg/l	1	D. Hidalgo	9/8/88
Magnesium	1	200.7	10 µg/l	1	D. Hidalgo	9/8/88
Manganese	1	200.7	3 µg/l	1	D. Hidalgo	9/8/88
Potassium	1	200.7	10 µg/l	1	D. Hidalgo	9/8/88
Silica	1	200.7	10 µg/l	1	D. Hidalgo	9/8/88
Phosphate	1	365.1	0.01 mg/l	3	D. Hobbs	9/9/88
Selenium	1	270.2	2 µg/l	1	G. Gilleland	9/15/88
Arsenic	1	206.2	1 µg/l	1	T. Carr	9/19/88
Total Dissolved Solids	1	160.1	10 mg/l	3	P. Huebner	8/29/88
Sulfate	1	375.3	0.1 mg/l	3	P. Huebner	8/29/88
Silver	1	200.7	5 µg/l	1	D. Hidalgo	9/8/88
Sodium	1	200.7	0.01 µg/l	1	D. Hidalgo	9/8/88
Zinc	1	200.7	5 µg/l	1	D. Hidalgo	9/8/88

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

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QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	LLD	Preservative	Analyst	Date(s) of Analysis
Alpha-Beta	4	1.0,2.0 pCi/l	3	M. Kidwell	9/1-9/12/88
Radium 226	4,7	0.2 pCi/l	3	Howard & Garcia	8/29-9/6/88
Thorium 230	11	0.2 pCi/l	3	Taylor & Ortiz	8/29-9/7/88
Uranium	9,10	0.2 pCi/l	3	B. Tonning	9/6-9/8/88

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HR023 (Hermit Shaft)	pH	7.21	7.19	0.3%
HR023 (Hermit Shaft)	Chloride	30.1	30.1	0.0%
HR023 (Hermit Shaft)	Alkalinity	235	235	0.0%
HR023 (Hermit Shaft)	Ammonia	<0.1	<0.1	0.0%
HR023 (Hermit Shaft)	Fluoride	1.15	1.16	0.9%
HR023 (Hermit Shaft)	Mercury	0.0005	0.0005	0.0%
HR023 (Hermit Shaft)	Barium	0.02	0.02	0.0%
HR023 (Hermit Shaft)	Cadmium	<0.005	<0.005	0.0%
HR023 (Hermit Shaft)	Chromium	0.09	0.09	0.0%
HR023 (Hermit Shaft)	Copper	0.02	0.02	0.0%
HR023 (Hermit Shaft)	Iron	0.62	0.62	0.0%
HR023 (Hermit Shaft)	Lead	<0.02	<0.02	0.0%
HR023 (Hermit Shaft)	Magnesium	172	173	0.06%
HR023 (Hermit Shaft)	Manganese	0.04	0.04	0.0%
HR023 (Hermit Shaft)	Potassium	25.1	25.4	1.2%
HR023 (Hermit Shaft)	Phosphate	<0.1	<0.1	0.0%
HR023 (Hermit Shaft)	Selenium	0.017	0.017	0.0%
HR023 (Hermit Shaft)	Arsenic	0.044	0.048	8.7%
HR023 (Hermit Shaft)	TDS	3250	3250	0.0%
HR023 (Hermit Shaft)	Sulfate	2020	2050	1.5%
HR023 (Hermit Shaft)	Silver	0.02	0.02	---
HR023 (Hermit Shaft)	Sodium	76.1	77.0	1.2%
HR023 (Hermit Shaft)	Zinc	0.079	0.079	0.0%

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LGN: 8635

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HR023 (Hermit Shaft)	Gross Alpha	1200 ± 100	1400 ± 100	7.7%
HR023 (Hermit Shaft)	Gross Beta	450 ± 20	530 ± 20	8.2%
HR023 (Hermit Shaft)	Uranium	0.0427	0.0413	1.7%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known
Chloride	27.5	25.85	22.3 - 28.7	6.3%
Ammonia	2.04	1.98	1.78 - 2.18	3.0%
Fluoride	0.49	0.50	0.45 - 0.55	2.0%
Mercury	0.002	0.002	0.001 - 0.022	0.0%
Barium	1.04	0.97	0.82 - 1.12	7.0%
Cadmium	0.198	0.200	0.170 - 0.230	1.0%
Calcium	2.05	2.00	1.70 - 2.30	2.5%
Chromium	0.211	0.200	0.170 - 0.230	5.5%
Copper	0.203	0.200	0.170 - 0.230	1.5%
Iron	0.204	0.200	0.170 - 0.230	2.0%
Lead	0.205	0.200	0.170 - 0.230	2.5%
Magnesium	0.201	0.200	0.170 - 0.230	0.5%
Manganese	0.208	0.200	0.170 - 0.230	4.0%
Potassium	10.1	10.0	8.5 - 11.5	1.0%
Silica	1.12	1.07	0.99 - 1.23	5.0%
Phosphate	0.50	0.50	0.46 - 0.54	0.0%
Selenium	0.008	0.009	0.006 - 0.012	11.0%
Arsenic	0.058	0.062	0.048 - 0.073	6.7%
Total Dissolved Solids	1460	1479	1331 - 1627	1.3%

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How are there "Known" values? Are these results taken from the Lab Accuracy results? See pages 1,010-1,011 and 1,417-1,422

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS (cont'd)

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known
Sulfate	1030	1000	900 - 1100	3.0%
Silver	0.98	0.99	0.84 - 1.14	1.0%
Sodium	0.81	0.86	0.73 - 0.99	5.0%
Zinc	0.206	0.200	0.170 - 0.230	3.0%
Gross Alpha	206 ± 4	198	178 - 218	3.9%
Gross Beta	181 ± 2	175	158 - 193	3.3%
Radium 226	106 ± 2	101	96 - 106	5.0%
Thorium 230	246 ± 20	267	254 - 280	8.5%
Uranium	32	34	32 - 36	5.9%

Parameter	Spike % Recovery
Cadmium	97
Barium	100
Chromium	128
Copper	100
Iron	131
Lead	109
Manganese	98
Potassium	106
Silver	95
Zinc	99

Approved by _____

?

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1466 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 356-1156

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 8851 Client PO No.

Sample Type: water

Date Collected: Date Received: 9/29/88 Date Reported: 11/15/88

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l	As Total mg/l
HR025 (Hermit Mine)	157	157	<1	<0.1	0.020
PN026 (Pinenut Mine)	191	191	<1	<0.1	0.034
LC027 (Fredonia Office)	187	187	<1	<0.1	0.031

Sample Identification	Ba Total mg/l	B Total mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l
HR025 (Hermit Mine)	0.04	0.38	<0.005	494	42.3	0.13
PN026 (Pinenut Mine)	0.02	0.36	<0.005	233	16.1	0.22
LC027 (Fredonia Office)	0.03	0.36	<0.005	223	16.1	0.22

Sample Identification	Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HR025 (Hermit Mine)	3340	0.02	1.32	6.21	<0.02	169
PN026 (Pinenut Mine)	2130	0.51	0.87	10.6	0.03	128
LC027 (Fredonia Office)	2130	0.50	0.88	10.4	<0.02	122

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LGN: 8851

Sample Identification	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO_3 as N mg/l	pH units	PO_4 as P mg/l
HR025 (Hermit Mine)	0.09	0.0003	0.05	<0.1	7.20	<0.1
PN026 (Pinenut Mine)	0.42	0.0003	0.10	<0.1	7.52	<0.1
LC027 (Fredonia Office)	0.40	0.0003	0.10	<0.1	7.50	0.2

Sample Identification	K Total mg/l	Se Total mg/l	SiO_2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l
HR025 (Hermit Mine)	19.4	0.037	11.0	0.02	69.5	3430
PN026 (Pinenut Mine)	18.7	0.024	8.64	0.02	51.6	1880
LC027 (Fredonia Office)	17.7	0.026	8.90	0.02	49.2	1900

Sample Identification	TSS mg/l	SO_4 mg/l	Zn Total mg/l	Sulfite Total mg/l
HR025 (Hermit Mine)	14	2080	0.070	<2
PN026 (Pinenut Mine)	25	1160	0.061	<2
LC027 (Fredonia Office)	18	1190	0.043	<2

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Sample Identification	Gross Alpha[1] (Total) pCi/liter ±Precision*	Gross Beta[1] (Total) pCi/liter ±Precision*	Ra-226 (Total) pCi/liter ±Precision*
HR025 (Hermit Mine)	76 ± 25	38 ± 11	0.4 ± 0.2
PN026 (Pinenut Mine)	42 ± 14	33 ± 7	1.9 ± 0.5
LC027 (Fredonia Office)	54 ± 15	34 ± 7	2.4 ± 0.5

Sample Identification	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HR025 (Hermit Mine)	0.4 ± 0.4	0.0022
PN026 (Pinenue Mine)	0.5 ± 0.5	0.0073
LC027 (Fredonia Office)	1.2 ± 0.7	0.0073

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

[1] Gross alpha & gross beta results are based on Thorium-230 and Strontium-90 calibration standards respectively.

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Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 8851

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 9/29/88 By: Sue Barkey Via: airplane

Sample Container Type: large cubes, small cubes
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received 4. Zn Acetate

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Chloride	1	325.3	0.2 mg/l	3	D. Hobbs	10/7/88
Nitrate	1	353.1	0.1 mg/l	2	D. Hobbs	10/12/88
Ammonia	1	350.1	0.1 mg/l	2	D. Hobbs	10/13/88
Barium	1	200.7	5 µg/l	1	D. Hidalgo	10/19/88
Boron	1	200.7	10 µg/l	1	D. Hidalgo	10/19/88
Cadmium	1	200.7	5 µg/l	1	D. Hidalgo	10/19/88
Calcium	1	200.7	10 µg/l	1	D. Hidalgo	10/19/88
Chromium	1	200.7	10 µg/l	1	D. Hidalgo	10/19/88
Copper	1	200.7	10 µg/l	1	D. Hidalgo	10/19/88
Iron	1	200.7	10 µg/l	1	D. Hidalgo	10/19/88
Lead	1	200.7	5 µg/l	1	D. Hidalgo	10/19/88
Magnesium	1	200.7	10 µg/l	1	D. Hidalgo	10/19/88
Manganese	1	200.7	3 µg/l	1	D. Hidalgo	10/19/88
Molybdenum	1	200.7	10 µg/l	1	D. Hidalgo	10/19/88
Arsenic	1	206.2	1 µg/l	1	G. Gilleland	10/20/88
pH	1	150.1	0.01 units	1	A. Knudson	10/6/88
Mercury	1	245.1	0.2 µg/l	1	G. Gilleland	10/25/88
Conductance	1	120.0	0.1 µmhos/cm	1	P. Huebner	10/27/88
Fluoride	1	340.2	0.1 mg/l	1	A. Knudson	10/27/88
Total Suspended Solids	1	160.2	4 mg/l	3	P. Huebner	10/11/88
Total Dissolved Solids	1	160.1	10 mg/l	3	P. Huebner	10/14/88
Sulfate	1	375.3	0.1 mg/l	3	P. Huebner	10/13/88
Silica	1	200.7	10 µg/l	1	D. Hidalgo	10/19/88
Silver	1	200.7	5 µg/l	1	D. Hidalgo	10/19/88

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QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Sodium	1	200.7	0.01 µg/l	1	D. Hidalgo	10/19/88
Zinc	1	200.7	5 µg/l	1	D. Hidalgo	10/19/88
Phosphate	1	365.1	0.01 mg/l	3	D. Hobbs	10/20/88
Selenium	1	270.2	2 µg/l	1	G. Gilleland	10/27/88
Alpha-Beta	4		1.0,2.0 pCi/l	3	M. Kidwell	10/13-10/18/88
Radium 226	4,7		0.2 pCi/l	3	Howard,Goodale,Garcia	10/19-10/24/8
Thorium 230	11		0.2 pCi/l	3	J. Ortiz	10/21-10/24/88
Uranium	4,14		0.2 pCi/l	3	B. Tonning	10/7-10/11/88

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
LC027 (Fredonia Office)	Chloride	16.1	16.1	0.0%
LC027 (Fredonia Office)	Nitrate	<0.1	<0.1	0.0%
LC027 (Fredonia Office)	Ammonia	<0.1	<0.1	0.0%
LC027 (Fredonia Office)	Barium	0.03	0.03	0.0%
LC027 (Fredonia Office)	Boron	0.36	0.36	0.0%
LC027 (Fredonia Office)	Cadmium	<0.005	<0.005	0.0%
LC027 (Fredonia Office)	Calcium	223	223	0.0%
LC027 (Fredonia Office)	Chromium	0.22	0.22	0.0%
LC027 (Fredonia Office)	Copper	0.50	0.50	0.0%
LC027 (Fredonia Office)	Iron	10.4	10.4	0.0%
LC027 (Fredonia Office)	Lead	<0.02	0.02	---
LC027 (Fredonia Office)	Magnesium	122	122	0.0%
LC027 (Fredonia Office)	Manganese	0.40	0.40	0.0%
LC027 (Fredonia Office)	Molybdenum	0.10	0.10	0.0%
LC027 (Fredonia Office)	Arsenic	0.031	0.031	0.0%
HR025 (Hermit Mine)	pH	7.20	7.19	0.1%
LC027 (Fredonia Office)	Mercury	0.0003	0.0003	0.0%
LC027 (Fredonia Office)	Conductance	2130	2130	0.0%
LC027 (Fredonia Office)	Fluoride	0.88	0.88	0.0%
PN026 (Pinenut Mine)	TSS	27	27	0.0%
LC027 (Fredonia Office)	TDS	1910	1880	1.6%

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LGN: 8851

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
LC027 (Fredonia Office)	Sulfate	1190	1180	0.8%
LC027 (Fredonia Office)	Potassium	17.7	17.7	0.0%
LC027 (Fredonia Office)	Silica	8.9	9.2	3.3%
LC027 (Fredonia Office)	Silver	0.02	0.02	0.0%
LC027 (Fredonia Office)	Sodium	49.2	49.3	0.2%
LC027 (Fredonia Office)	Zinc	0.043	0.042	2.3%
LC027 (Fredonia Office)	Phosphate	0.2	0.2	0.0%
PN026 (Pinenut Mine)	Selenium	0.024	0.024	0.0%
LC027 (Fredonia Office)	Uranium	0.0071	0.0074	2.1%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known
Chloride	26.6	26.05	24.1 - 27.7	2.0%
Nitrate	2.02	1.98	1.78 - 2.18	2.0%
Ammonia	2.09	1.98	1.78 - 2.18	5.4%
Barium	1.04	0.97	0.82 - 1.12	7.0%
Boron	0.97	0.99	0.84 - 1.14	2.0%
Cadmium	0.192	0.200	0.170 - 0.230	4.0%
Calcium	1.92	2.00	1.70 - 2.30	4.0%
Chromium	0.211	0.200	0.170 - 0.230	5.5%
Copper	0.194	0.200	0.170 - 0.230	3.0%
Iron	0.189	0.200	0.170 - 0.230	5.5%
Lead	0.188	0.200	0.170 - 0.230	6.0%
Magnesium	0.201	0.200	0.170 - 0.230	0.5%
Manganese	0.191	0.200	0.170 - 0.230	4.5%
Molybdenum	0.189	0.200	0.170 - 0.230	5.5%
Arsenic	0.097	0.100	0.080 - 0.118	3.0%
Mercury	0.005	0.005	0.004 - 0.006	0.0%
Fluoride	0.51	0.50	0.45 - 0.55	2.0%
TDS	1474	1479	1331 - 1627	0.3%

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LGN: 8851

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS (cont'd)

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known
Sulfate	1064	1000	900 - 1100	6.4%
Potassium	9.1	10.0	8.5 - 11.5	9.0%
Silica	1.09	1.07	0.93 - 1.23	2.0%
Silver	0.99	1.00	0.85 - 1.15	1.0%
Sodium	0.80	0.86	0.73 - 0.99	6.0%
Zinc	0.194	0.200	0.170 - 0.230	3.0%
Selenium	0.008	0.009	0.006 - 0.012	11.0%
Gross Alpha	213 ± 4	198	178 - 218	7.0%
Gross Beta	179 ± 2	175	158 - 193	2.2%
Radium 226	96 ± 2	101	96 - 106	5.0%
Thorium 230	110 ± 3	99	94 - 104	10.0%
Uranium	34	34	32 - 36	0.0%

Parameter	Spike % Recovery
Chloride	102
Nitrate	83
Ammonia	96
Barium	102
Boron	101
Cadmium	96
Chromium	106
Copper	108
Lead	97
Manganese	104
Molybdenum	97
Arsenic	104
Mercury	76
Potassium	94
Silver	91
Zinc	96
Selenium	76

Approved by _____

SEND TO: BARRINGER LABS
15000 WEST 6TH AVE. SUITE 300
GOLDEN, COLORADO. 80401

CHAIN OF CUSTODY RECORD - CLIENT COPY

SENT FROM:

Sampler's Name: LAURENCE L. CASEBOLT
Company Name: ENERGY FUELS NUCLEAR INC.
Company Address: P.O. BOX 36
FREDONIA AZ 86022

I.D. #	Client I.D. #	Sample Location	Date/Time of Sampling	Raw, Unfiltered, Plastic	Raw, Filtered, Plastic	Raw, Filtered, Glass	HNO_3, Filtered, Plastic	H_2SO_4, Filtered, Glass	2N Acetic NaOH	PLASTIC FILTERED PLASTIC		Total Number of Bottles	(Instructions for Analysis on back of form) Comments
	HR025	HERMIT MINE		✓			✓	✓	✓			4	
	PR1026	PINEDUT MINE		✓			✓	✓	✓			4	
	LC027	FREDONIA OFFICE		✓			✓	✓	✓			4	

Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Date/Time
Laurence L. Casebolt	9/29/88 10:10 AM	Susan K Barkley	9/29/88
Relinquished By: (Signature)	Date/Time	Received for BLI By: (Signature)	Date/Time

Shipping Information
Carrier: _____
Date Shipped: 9/29/88

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011

H-4515.124
H-[redacted]71

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Inter-Office Memorandum

DATE: October 19, 1987

TO: Miguel Santiago, EHS II
Water Permits Unit

THRU: Debra Daniel, Manager DD
State Permits Hydrology Unit

FROM: Michael Leach, Hydrologist ML
State Permits Hydrology Unit

RE: Hermit and Pinenut Mines

Due to the great similarity between the above referenced facilities, their Draft Groundwater Quality Protection Permits have been reviewed together and the following comments have been made:

1) Upon obtaining all of Phase I (pre-mining) water quality data as described in Part II.B.1.a of the draft permits, a report which summarizes the water quality data and establishes the Maximum Groundwater Limit (MGL) for each sampling parameter should be submitted to ADEQ for each facility. MGL's should be assigned using the procedure described in Part II.B.2.b. of the draft permits.

2) The proposed Phase III (post-mining) groundwater sampling frequency and subsequent data manipulation used to determine the eventual cessation of sampling activities (described in Part II.B.1.c.2. of the draft permits) should be changed. The problem is that the draft permit does not take into consideration the potential length of time necessary for any contaminated water from the mine shaft to travel several hundred feet to the regional water table. If the vadose zone is not substantially fractured, travel times could take several years, depending on the vertical permeability of the vadose zone rock formations. Therefore, a long-term, post-closure sampling program should be implemented. This sampling program should last 15 years with semi-annual sampling of the on-site water supply/monitor well. (Hermit and Pinenut Mine) and the spring at Willow Springs (Pinenut Mine). Water quality analyses should include the parameters listed in Part II.B.2.b. of the draft permit, and MGL's should remain the same as calculated for Phase II (mining) groundwater monitoring.

3) The contingency requirements listed in Part II.C.2. of the Pinenut Mine draft permit should include a report which assesses the impacts of a confirmed exceedence of an MGL occurring at the spring at Willow Springs.

ML:dl

File 4515.124

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Inter-Office Memorandum

October 13, 1988

TO: See Distribution

THRU: Gary Ullinskey, Program Supervisor GU
Water Permits Unit, New Facilities Team

FROM: Miguel A. Santiago, EHS - II
Water Permits Unit

RE: Groundwater Quality Protection Permits
No. G-0035-08 (Hermit Mine)
and G-0036-08 (Pinenut Mine) Minor Modification

The attached pages are modifications made to the above referenced permits. Please insert these pages, according to the permit number on the above right hand corner, to your respective copies.

If you have any questions or comments, you may contact me at 257-2270.

Attachment

MS:jm

DISTRIBUTION:

Robert Hollander, Manager, Central Regional Office
Compliance Unit
Health Services Laboratory Licensure Program Manager
Hydrology Unit

(Cont'd.)

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Chloride	Reserved**	3	325.3
Chromium (total)	Reserved**	1	218.2
Copper	Reserved**	2	220.1
Fluoride	Reserved**	3	340.2
Iron	Reserved**	2	236.1
Lead	Reserved**	1	239.2
Magnesium	Reserved**	2	243.1
Manganese	Reserved**	2	243.1
Mercury	Reserved**	1	245.1
Nitrate (as N)	Reserved**	3	---
Phosphate	Reserved**	4	424
Potassium	Reserved**	2	258.1
Selenium	Reserved**	1	270.2
Silver	Reserved**	2	272.1
Silica	Reserved**	-	---
Sodium	Reserved**	2	273.1
Sulfate	Reserved**	3	375.3
Total Dissolved Solids	Reserved**	3	160.3
Zinc	Reserved**	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved**	3	120.1
	(picocuries per liter)		
Gross Alpha	Reserved**	4,13	703
Gross Beta	Reserved**	4,13	703
Total Uranium	Reserved**	9,10	---
Thorium 230	Reserved**	9,10	---
Radium 226	Reserved**	4,7	705,706

(1)Standard references are listed on Attachment I to this Permit.

** Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

file

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

EVAN MECHAM, GOVERNOR
GERALD H. TELETZKE, PH.D., DIRECTOR

October 13, 1988

Mr. William J. Almas
Environmental Coordinator
Energy Fuels Nuclear
1200 17th Street, Suite 2500
Denver, Colorado 80202

Dear Mr. Almas:

RE: Hermit Mine G-0035-08
Pinenut Mine G-0036-08

Your request for modification of the Groundwater Quality Protection Permits for the above referenced facilities has been evaluated by the Department.

As indicated in the attached pages of the permits, Alert Levels and Maximum Groundwater Limits will be determined upon completion of the pre-mining phase of operations. Please insert these pages into your copies of the permits.

If you have any questions, you may contact me at (602) 257-2270.

Sincerely,

Miguel A. Santiago
Water Permits Unit

MS:jm

Attachment

cc: Mohave County Health Department

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	0.025	1	206.2
Barium	0.5	2	208.1
Cadmium	0.005	1	213.2
Copper	0.5	2	220.1
Iron	0.15	2	236.1
Lead	0.025	1	239.2
Manganese	Reserved*	2	242.1
Mercury	0.001	1	245.1
Nitrate (as N)	5.0	3	---
Selenium	0.005	1	270.2
Silver	0.025	2	272.1
Zinc	5.0	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	5.0	4,13	703
Gross Beta	5.0	4,13	703

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved*	4	403
Arsenic	0.05	1	206.2
Barium	1.0	2	208.1
Bicarbonate	Reserved*	3	305.1
Cadmium	0.010	1	213.2
Calcium	Reserved*	2	215.1
Carbonate	Reserved*	4	403
Chloride	Reserved*	3	325.3
Chromium (total)	0.05	1	218.2
Copper	1.0	2	220.1

(1)Standard references are listed on Attachment I to this Permit.

(Continued)

PARAMETER	MAXIMUM GROUND-WATER LIMITS	REF I.D.(1)	METHOD OF ANALYSIS
	(milligrams per liter)		
Fluoride	2.4	3	340.2
Iron	0.3	2	236.1
Lead	0.05	1	239.2
Magnesium	Reserved*	2	243.1
Manganese	Reserved*	2	243.1
Mercury	0.002	1	245.1
Nitrate (as N)	10.0	3	---
Phosphate	Reserved*	4	424
Potassium	Reserved*	2	258.1
Selenium	0.01	1	270.2
Silver	0.05	2	272.1
Silica	Reserved*	-	---
Sodium	Reserved*	2	273.1
Sulfate	Reserved*	3	375.3
Total Dissolved Solids	Reserved*	3	160.3
Zinc	Reserved*	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved*	3	120.1
	(picocuries per liter)		
Gross Alpha	15	4,13	703
Gross Beta	50	4,13	703
Total Uranium	Reserved*	9,10	---
Thorium 230	Reserved*	9,10	---
Radium 226	Reserved*	4,7	705,706

(1)Standard references are listed on Attachment I to this Permit.

* Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

H-4515.174

ARIZ[illegible] DEPARTMENT OF ENVIRONMENTAL [illegible]

[illegible]r-Office Memorandum

DATE: September 14, 1988

TO: Miguel Santiago
Water Permits Unit

THRU: Debra Daniel, Manager DD
State Permits Hydrology Unit

FROM: Michael Leach, Hydrologist ML
State Permits Hydrology Unit

RE: Canyon Mine



This memo is in response to the concern expressed in your communication of September 1, 1988 surrounding the establishment of Alert Levels for chemical constituents listed in Part II.B.2.a. of the groundwater permit for the above referenced facility. As in the case of the Maximum Groundwater Limits (MGL's), establishment of Alert Levels will be based upon ambient groundwater quality obtained from pre-mining groundwater sampling activities. However, as opposed to MGL's, establishment of Alert Levels may be somewhat subjective in that such aspects as data variability or data precision will be taken into consideration. In addition, ambient concentrations of chemical parameters which naturally exceed an established Maximum Contaminant Limit (MCL) will not have Alert Levels since in this instance there will be a non-degradation policy. For instance initial sampling events indicate that gross alpha particle activity has naturally exceeded the established MCL. At this time there is very little groundwater data available to establish either MGL's or Action Levels, and determination of acceptable groundwater quality standards should occur upon completion of the pre-mining phase of operations. Therefore, the Alert Levels listed in Part II.B.2.a. of the groundwater permit should all be listed as "Reserved".

ML:dl

Gary: This is hydro's response to my concern about the establishment of MGL's and Alert Levels for the Uranium Mines. He doesn't specify any methodology for setting of Alert Levels. I suggest that instead of being as specific as we are with the MGL "reserve" meaning, we can say that the Alert Levels shall be established once the ambient G-W monitoring results are evaluated by the Department. What do you think? To me Sounds OK. Miguel G.

TO: Mike Leach

RU: Debra Daniel
Hydrology

FROM: Miguel A. Santiago
W.P.U.

SUBJECT Canyon Mine GWQPP

DATE 8/1/88

MESSAGE Attached are the analytical results of Canyon mine monitoring. As with Hermit & Pincnut mines, they are requesting modification of parameter limits to reflect ambient groundwater. I agree that the MCL's should be established once ambient G-W monitoring is done, through a statistical analyses of results. However, how should the alert Levels (which are different from MCL's) be established? The

SIGNED

REPLY permits do not state how these alert levels are to be established.

SIGNED Miguel A. Santiago DATE 8/1/88

REDIFORM 4S 472

SEND PARTS 1 AND 3 INTACT - PART 3 WILL BE RETURNED WITH REPLY.

carbonless POLY PAK (50 SETS) 4P472

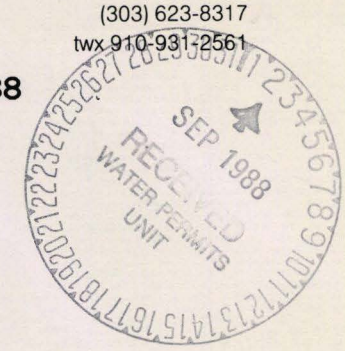
DETACH AND FILE FOR FOLLOW-UP

2nd Quarter 1988

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561



September 1, 1988

Mr. Miguel Santiago
Environmental Health Specialist
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine Groundwater Protection Permit No. 6-0004-03

Dear Mr. Santiago:

Enclosed please find Second Quarter analytical results from the Hermit Mine Monitor Well. The well was sampled on June 28, 1988. Samples were obtained following procedures outlined in the Groundwater Protection Permit. Analysis was performed for the comprehensive list of parameters given in Part II.B.2.b. of the Groundwater Protection Permit and are identified on the laboratory analytical report as Sample Identification HR 019. Also enclosed are pH, conductivity and temperature measurements taken at the time of sampling. Static water level was recorded just prior to turning the pump on to void the well casing prior to sampling.

Please note that sample analysis results have not been submitted on ADEQ Self-Monitoring Forms. This is because not all parameters for which Energy Fuels Nuclear (EFN) samples are included on the form. Please advise as to the appropriate format for submittal of quarterly analytical data in the future. Also, as previously indicated by EFN, certain parameters equal or exceed Alert Levels and/or Maximum Groundwater Limits. These exceedances are a result of ADEQ setting of arbitrary levels for Alert or Maximum levels, rather than taking ambient concentrations of groundwater into consideration. EFN requests that these regulatory limits be modified to reflect background concentrations of constituents within water coming from the Redwall-Mauv aquifer.

If you have any questions concerning this matter, please contact me at our Denver office.

Sincerely,

William J. Almas
Environmental Coordinator

WJA:smm
Enclosure
FEDERAL EXPRESS

SUMMARY OF FIELD DATA

SECOND QUARTER SAMPLING, 1988

HERMIT MINE

DATE OF SAMPLE: June 29, 1988

pH:	6.54	*GW slightly acidic*
EC:	2760 µmhos	
Temperature:	24.5°C	
Static Water Level:	3384.4 MSL	*Surface elevation: 4,886' amsl*
	1,501.6 ft bls	

Groundwater samples were preserved and put on ice immediately after collection. Groundwater samples for radiometric and trace constituent analysis were preserved with nitric acid. Groundwater samples for phosphate and nitrate analysis were preserved with sulfuric acid. Groundwater samples for routine analysis were filtered.

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
Suite 2500
1200-17th Street
Denver, CO 80202

ATTN: Bill Almas

Client No. Log No. 8386 Client PO No.

Sample Type: water

Hermit sampled: 6/29/1988

Date Collected: Date Received: 7/13/88 Date Reported: 8/17/88

INORGANIC FINAL
RESULTS OF ANALYSIS

Alkalinity and bicarbonate should be separate measurements

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
CN017	204	204	<1	<0.001	0.10
PN018	173	173	<1	0.015	0.02
HR019	155	155	<1	0.015	0.02
KN020	165	165	<1	0.014	0.02
PG021	200	200	<1	0.015	0.02
LC022	155	155	<1	0.014	0.02

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance µmho/cm	Cu Total mg/l
CN017	0.010	46.2	6.3	0.03	437	<0.01
PN018	0.017	294	15	0.11	2140	0.03
HR019	0.025	577	41	0.15	3210	0.02
KN020	0.014	357	68	0.11	2460	0.03
PG021	0.025	125	32	0.15	1170	0.02
LC022	0.014	567	41	0.11	3210	0.03

Fredonia office

Approved by

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
CN017	0.34	0.24	0.04	31.1	0.04	0.0004
PN018	0.89	10.0	0.11	146	0.55	0.0004
HR019	1.39	7.48	0.15	192	0.11	0.0011
KN020	1.10	9.02	0.09	136	0.12	0.0004
PG021	1.59	7.32	0.14	44.5	0.11	0.0006
LC022	1.38	8.76	0.11	188	0.12	0.0015

Sample Identification	NO_3 as N mg/l	PO_4 mg/l	K Total mg/l	Se Total mg/l	SiO_2 Total mg/l	Ag Total mg/l
CN017	<0.1	<0.01	3.2	0.004	10.0	<0.01
PN018	<0.1	<0.01	18.9	0.004	10.0	0.01
HR019	<0.1	<0.01	24.4	0.006	12.8	0.02
KN020	<0.1	<0.01	18.8	0.005	11.7	0.01
PG021	<0.1	<0.01	19.6	0.006	12.8	0.02
LC022	<0.1	<0.01	24.1	0.005	11.3	0.02

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

Sample Identification	Na Total mg/l	TDS mg/l	SO_4 mg/l	Zn Total mg/l
CN017	6.32	256	17	0.450
PN018	48.1	2010	1290	0.127
HR019	78.8	3450	2240	0.118
KN020	108	2340	1460	0.087
PG021	83.9	3450	384	0.166
LC022	77.3	3480	2260	0.117

Date collected between June 29 - July 13, 1988

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Feuls
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

QUALITY CONTROL DATA SHEET

Time Received: Date: 7/13/88 By: Gina Reichert Via: Federal Express

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received 4. Zn Acetate

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Barium	1	200.7	5 µg/l	1	D. Hidalgo	7/19/88
Cadmium	1	200.7	5 µg/l	1	D. Hidalgo	7/19/88
Calcium	1	200.7	10 µg/l	1	D. Hidalgo	7/19/88
Chromium	1	200.7	10 µg/l	1	D. Hidalgo	7/19/88
Copper	1	200.7	10 µg/l	1	D. Hidalgo	7/19/88
Iron	1	200.7	10 µg/l	1	D. Hidalgo	7/19/88
Lead	1	200.7	5 µg/l	1	D. Hidalgo	7/19/88
Magensium	1	200.7	10 µg/l	1	D. Hidalgo	7/19/88
Manganese	1	200.7	3 µg/l	1	D. Hidalgo	7/19/88
Silver	1	200.7	5 µg/l	1	D. Hidalgo	7/19/88
Potassium	1	200.7	10 µg/l	1	D. Hidalgo	7/19/88
Silica	1	200.7	10 µg/l	1	D. Hidalgo	7/19/88
Arsenic	1	206.2	1 µg/l	1	T. Carr	7/18/88
Fluoride	1	340.2	0.1 mg/l	3	A. Knduson	7/18/88
Mercury	1	245.1	0.2 µg/l	1	G. Gilleland	7/19/88
Selenium	1	270.2	2 µg/l	1	G. Gilleland	7/20/88
Nitrate	1	353.1	0.1 mg/l	2	D. Hobbs	7/21/88
Conductance	1	120.1	0.1 µmhos/cm	3	J. Hageman	7/25/88
Chloride	1	325.3	0.2 mg/l	3	D. Hobbs	7/26/88
Alkalinity	1	310.1	0.5 mg/l	3	A. Knduson	8/3/88
Phosphate	1	365.1	0.01 mg/l	3	D. Hobbs	8/10/88
Sodium	1	200.7	0.01 µg/l ?	1	D. Hidalgo	7/19/88
Zinc	1	200.7	5 µg/l	1	D. Hidalgo	7/19/88

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Total Dissolved Solids	1	160.1	10 mg/l	3	J. Hageman	7/20/88
Sulfate	1	375.3	0.1 mg/l	3	J. Hageman	7/20/88

This is a mixture of different mines' groundwater for different elements

DUPLICATES

Sample Identification		Parameter	Result	Result	Relative Deviation From Mean
CN017	Canyon Mine	Barium	0.10	0.10	0.0%
CN017		Cadmium	0.010	<0.005	---
CN017		Calcium	46.2	46.4	0.4%
CN017		Chromium	0.03	0.03	0.0%
CN017		Copper	<0.01	<0.01	0.0%
CN017		Iron	0.24	0.23	4.2%
CN017		Lead	0.04	0.04	0.0%
CN017		Magnesium	31.1	31.2	0.3%
CN017		Manganese	0.04	0.04	0.0%
CN017		Silver	<0.01	<0.01	0.0%
CN017		Potassium	3.2	3.1	3.1%
CN017		Silica	10.0	10.1	1.0%
CN017		Arsenic	<0.001	<0.001	0.0%
PG021	Pigeon	Fluroide	1.59	1.59	0.0%
HR019	Hermit	Mercury	0.0011	0.0010	9.0%
PN018	Pinenut	Selenium	0.004	0.004	0.0%
LC022	Fredonia office	Nitrate	<0.1	<0.1	0.0%
PN018		Conductance	2110	2170	2.8%
LC022		Chloride	41	41	0.0%
LC022		Alkalinity	155	155	0.0%
LC022		Phosphate	<0.1	<0.1	0.0%
CN017		Sodium	6.32	6.36	0.6%

Approved by _____

Barringer Laboratories
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Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
CN017	Zinc	0.570	0.548	3.8%
HR019	Sulfate	2250	2220	1.3%

QUALITY CONTROL STANDARDS

These may be results from spiked sample test, see pages 1,009 -1,011

No sample ID

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known
Barium	0.98	0.97	0.82 - 1.12	1.0%
Cadmium	0.209	0.200	0.170 - 0.230	4.5%
Calcium	1.99	2.00	1.70 - 2.30	0.5%
Chromium	0.196	0.200	0.170 - 0.230	2.0%
Copper	0.201	0.200	0.170 - 0.230	0.5%
Iron	0.212	0.200	0.170 - 0.230	6.0%
Lead	0.191	0.200	0.170 - 0.230	4.5%
Magnesium	0.203	0.200	0.170 - 0.230	1.5%
Manganese	0.201	0.200	0.170 - 0.230	0.5%
Silver	0.87	0.99	0.84 - 1.14	12.0%
Potassium	10.6	10.0	8.5 - 11.5	6.0%
Silica	1.03	1.07	0.91 - 1.23	4.0%
Arsenic	0.103	0.100	0.080 - 0.118	2.9%
Fluoride	0.50	0.50	22.3 - 28.7	0.0%
Mercury	0.0013	0.0016	0.0011 - 0.0021	20.0%
Selenium	0.010	0.009	0.006 - 0.012	10.0%
Nitrate	2.0	1.98	1.78 - 2.18	1.0%
Chloride	25.5	25.85	22.3 - 28.7	1.4%
Phosphate	0.48	0.50	0.46 - 0.54	4.1%

Approved by _____

Barringer Laboratories
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(303) 277-1687

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS (cont'd)

No sample ID

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known
Sodium	0.87	0.86	0.73 - 0.99	1.0%
Zinc	0.193	0.200	0.170 - 0.230	3.6%
Total Dissolved Solids	1472	1479	1331 - 1627	0.4%
Sulfate	1049	1000	900 - 1100	4.7%

These may be results from spiked sample test, see pages 1,109 -1,111

Parameter	Spike % Recovery
Cadmium	102
Chromium	97
Copper	97
Iron	101
Lead	107
Manganese	93
Arsenic	88
Fluoride	95
Mercury	108
Selenium	98
Nitrate	97

Approved by _____

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

Client No. | Log No. 8386 | Client PO No.

Sample Type: water

Date Collected: | Date Received: 7/13/88 | Date Reported: 8/10/88

RADIOCHEMISTRY FINAL RESULTS OF ANALYSIS **

Sample Identification	Gross Alpha Total pCi/l ±Precision*	Gross Beta Total pCi/l ±Precision*	Ra-226 Total pCi/l ±Precision*
CN017	18 ± 4	8.0 ± 1.5	2.2 ± 0.5
PN018	54 ± 17	38 ± 7	12 ± 1
HR019	0 ± 16	27 ± 10	2.6 ± 0.6
KN020	10 ± 13	19 ± 7	1.0 ± 0.4
PG021	11 ± 7	21 ± 3	2.7 ± 0.6
LC022	12 ± 18	25 ± 9	2.6 ± 0.6

How is gross beta higher than gross alpha?

How is Ra-226 alpha greater than gross alpha?

Sample Identification	Th-230 Total pCi/l ±Precision*	U Total mg/l
CN017	0.4 ± 0.6	0.0178
PN018	0.9 ± 0.7	0.0101
HR019	0.7 ± 0.7	0.0025
KN020	0.6 ± 0.6	0.0019
PG021	0.0 ± 0.4	0.0033
LC022	0.0 ± 0.5	0.0028

The method that Barringer Labs used could only measure a lowest limit of 0.005 mg/L. These results are below the lowest detection limit and more precise than could have been measured

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

** Inorganic results to follow at a later date

Approved by W. Barker

Note location of signature line to line on page 258

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

QUALITY CONTROL DATA SHEET

Time Received: Date: 7/13/88 By: Gina Reichert Via: Federal Express

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received 4. Zn Acetate

Additional Lab Preparation: none

Parameter	Reference	LLD	Preservative	Analyst	Date(s) of Analysis
Alpha-Beta	4	1.0,2.0 pCi/l	3	Ortiz & Kidwell	7/14-7/21/88
Radium 226	4,7	0.2 pCi/l	3	Howard, Goodale, Kidwell & Garcia	7/26-7/29/88
Thorium 230	11	0.2 pCi/l	3	Ortiz & Taylor	7/15-7/28/88
Uranium	9,10	0.2 pCi/l	3	B. Tonning	7/22-7/25/88

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Gross Alpha	193 ± 4	198	178 - 218	2.6%	---
Gross Beta	178 ± 2	175	157 - 193	1.7%	---
Radium 226	109 ± 3	101	96 - 106	8.0%	---
Thorium 230	100 ± 3	99	94 - 104	1.0%	---
Uranium	34	34	32 - 36	0.0%	101

How is Ra-226 alpha higher than for U? 34 pCi/L correlates to ≈50 ppb of U

How is Th-230 alpha so high? It should be the lowest

Sum of Ra-226, Th-230 & U = 243 pCi/L, how is this higher than the gross alpha?

Approved by D. Parker

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Inter-Office Memorandum

August 22, 1988

TO: FILE

THRU: Gary Ullinskey, Program Supervisor
Groundwater Permits New Facilities TEam

Skip Hellerud, Manager
Water Permits Unit

FROM: Miguel A. Santiago, EHS II
Groundwater Permits New Facilities Team

RE: Groundwater Quality Protection Permits
G-0036-08 Pinenut Mine
G-0035-08 Hermit Mine
Minor Modifications

By means of a letter dated July 19, 1988, Mr. Rich A. Munson, Corporate Counsel for Energy Fuels Nuclear, Inc., has requested a modification to the above-referenced permits. Both facilities are still in the pre-mining phase, where ambient groundwater characteristics are to be determined according to the analytical results of groundwater monitoring. Analytical reports for groundwater samples taken during the second calendar quarter of 1988 for the mines show that the ambient water quality for some parameters exceeds the alert levels and MGL's established in the permits.

Energy Fuels Nuclear states that since the mines are still in the development phase, it is apparent that the established alert levels and MGL's have been set at levels higher than ambient groundwater quality, and therefore request that these established parameters be reserved and re-established on the basis of on-going monitoring.

The State Permits Hydrology Unit recommends that all the alert levels and MGL's listed in each permit should be labeled as "reserved" until the statistical analysis of the pre-mining (ambient water) analytical results has been completed (see attached memo from Hydrology).

Attached are copies of Part II.2.a, and b which are the same for both permits, showing the current alert levels and MGL's. All the alert levels and MGL's will be labeled as Reserved in the modified permit.

MAS:mdm

Attachments

H-4515.171

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Inter-Office Memorandum

DATE: August 8, 1988

TO: Miguel Santiago
Water Permits Unit

THRU: Debra Daniel, Manager DLD
State Permits Hydrology Unit

FROM: Michael Leach, Hydrologist MDL
State Permits Hydrology Unit

RE: Hermit and Pinenut Uranium Mines



Part II.B.1.a of the signed Groundwater Quality Protection Permit for each of the above referenced facilities states that groundwater quality data obtained during pre-mining activities (present stage at both facilities) will be used to determine the ambient groundwater characteristics and establish Alert Levels and Maximum Groundwater Limits (MGL's). Many of the Alert Levels and MGL's given in the list of parameters for groundwater sampling do list Alert Levels and MGL's as being "reserved", or to be determined at a later date after statistical analysis of previous groundwater sampling results has been completed. However, many parameters are not based on ambient groundwater quality and have Alert Levels and MGL's listed in the permits according to existing groundwater quality standards. This is in disagreement with Part II.B.2.b.(1). of each permit which states that for chemical parameters that already have groundwater quality standards established by a federal or state regulatory agency there are two situations which may occur:

1. If the arithmetic mean plus two standard deviations of concentrations of a parameter obtained from groundwater samples during the pre-mining period do not exceed the established standards, then the MGL (from which the Alert Level will be obtained) shall be the established standard.

2. If the arithmetic mean plus two standard deviations of concentrations of a parameter exceeds the established standard, then the MGL shall be the arithmetic mean plus two standard deviations.

Since it is uncertain whether or not a certain chemical parameter will naturally exceed its established drinking water standard before all of the ambient water quality data has been collected, all of the Alert Levels and MGL's listed in each permit should be labeled as "reserved" until the statistical analysis has been completed on the ambient water quality data.

ML:dl

H-4515.171

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Inter-Office Memorandum

DATE: August 8, 1988

TO: Miguel Santiago
Water Permits Unit

THRU: Debra Daniel, Manager DLD
State Permits Hydrology Unit

FROM: Michael Leach, Hydrologist MDL
State Permits Hydrology Unit

RE: Hermit and Pinenut Uranium Mines

Part II.B.1.a of the signed Groundwater Quality Protection Permit for each of the above referenced facilities states that groundwater quality data obtained during pre-mining activities (present stage at both facilities) will be used to determine the ambient groundwater characteristics and establish Alert Levels and Maximum Groundwater Limits (MGL's). Many of the Alert Levels and MGL's given in the list of parameters for groundwater sampling do list Alert Levels and MGL's as being "reserved", or to be determined at a later date after statistical analysis of previous groundwater sampling results has been completed. However, many parameters are not based on ambient groundwater quality and have Alert Levels and MGL's listed in the permits according to existing groundwater quality standards. This is in disagreement with Part II.B.2.b.(1). of each permit which states that for chemical parameters that already have groundwater quality standards established by a federal or state regulatory agency there are two situations which may occur:

1. If the arithmetic mean plus two standard deviations of concentrations of a parameter obtained from groundwater samples during the pre-mining period do not exceed the established standards, then the MGL (from which the Alert Level will be obtained) shall be the established standard.

2. If the arithmetic mean plus two standard deviations of concentrations of a parameter exceeds the established standard, then the MGL shall be the arithmetic mean plus two standard deviations.

Since it is uncertain whether or not a certain chemical parameter will naturally exceed its established drinking water standard before all of the ambient water quality data has been collected, all of the Alert Levels and MGL's listed in each permit should be labeled as "reserved" until the statistical analysis has been completed on the ambient water quality data.

ML:dl

FROM Jule Leach

THRU Debra Harris
Hydrology Unit

RETURN TO Miguel Santiago
W.P.U.

SUBJECT Hermit & Pinenut Mines DATE 7/25/88

MESSAGE

Attached are analytical results for the above mines. I need to discuss results with you and address their request. Please contact me when you can.

P.S. I have the permit Thanks,

RETURN TO Files. SIGNED Miguel Santiago

REPLY

SIGNED DATE / /

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561

July 19, 1988

Mr. Miguel A. Santiago
Water Permits Unit
Office of Water Quality
Arizona Department of Environmental Quality
Central Palm Plaza Building
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine and Pinenut Mine Groundwater Analysis

Dear Mr. Santiago:

Enclosed herewith please find analytical reports for groundwater samples taken during the second calendar quarter of 1988 for the Hermit Mine, Groundwater Permit No. G-0035-08, and the Pinenut Mine, Groundwater Permit No. G-0036-08.

Please note that the analytical results show that the ambient water quality for some parameters exceeds the Alert Levels and Maximum Groundwater Limits established in the permits for the Hermit and Pinenut Mines. Specifically, we would call your attention to the Alert Levels and Maximum Groundwater Limits for Manganese, Iron, Gross Alpha, Gross Beta, and the Maximum Groundwater Limit for Chromium.

Because Energy Fuels is still in the development phase of operations at these sites and, therefore, could not have affected groundwater quality at this early stage, if is apparent that Alert Levels have been set at levels higher than existing water quality. Accordingly, we request that the Groundwater Permits be modified to provide that these parameters be "Reserved" and established in the same manner as those other parameters to be established on the basis of ongoing monitoring. We believe that such a modification would be a minor modification to the permits as we are only correcting a provision of the existing permits to allow the permittee to better comply with the purpose of Phase I monitoring, i.e., to determine ambient groundwater characteristics.

Just sinking the mineshaft and exploration drilling can affect the groundwater

If I can provide any further information, please contact me at your convenience.

Sincerely,

Rich A. Munson
Corporate Counsel

/ram

Encs.

VIA FEDERAL EXPRESS

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fules Nuclear
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

Client No. Log No. 8106 Client PO No.

Sample Type: water

Date Collected: 4/28-4/29/88 Date Received: 5/2/88 Date Reported: 6/28/88

carbonate and bicarbonate are not the same measurement

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l	As Total mg/l
HR012	159	159	<1	<0.1	0.013
PN011	183	183	<1	<0.1	0.003

Sample Identification	Ba Total mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance µmho/cm
HR012	0.01	<0.005	585	43	0.10	3430
PN011	0.01	<0.005	282	16	0.07	2170

Sample Identification	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HR012	0.01	1.47	4.03	<0.02	183	0.06
PN011	0.01	0.91	3.42	<0.02	136	0.32

Approved by _____

BARRINGER LABORATORIES INC.

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1455 DEMING WAY, SUITE 15
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PHONE: (702) 358-1158

Energy Fuels Nuclear
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	pH units	PO_4 mg/l	K Total mg/l	Se Total mg/l
HR012	0.0011	0.7	8.02	<0.1	25.3	0.009
PN011	0.0012	<0.1	8.17	<0.1	19.0	0.007

Sample Identification	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l
HR012	13.6	0.01	70.1	3500	18	2230	<0.005
PN011	11.7	0.01	46.4	1970	14	1210	0.011

Sample Identification	Gross Alpha Total pCi/l ±Precision*	Gross Beta Total pCi/l ±Precision*	Pb-210 Total pCi/l ±Precision*
HR012	0 ± 19	31 ± 12	0.5 ± 0.9
PN011	22 ± 14	26 ± 8	0.4 ± 0.7

How is gross alpha 0 but beta is 31?
How is the Gross Alpha less than the Ra-226 measurement?

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN:Rich Munson

LGN: 8106

Sample Identification	Po-210 Total pCi/l ±Precision*	Ra-226 Total pCi/l ±Precision*	Ra-228 Total pCi/l ±Precision*
HR012	0.8 ± 0.5	3.5 ± 0.7	0.0 ± 0.7
PN011	0.4 ± 0.4	10 ± 1	0.5 ± 0.8

Sample Identification	Th-230 Total pCi/l ±Precision*	U Total mg/l
HR012	0.0 ± 0.3	0.0025
PN011	0.5 ± 0.5	0.0096

Barringer Labs did not have the capacity to measure a U concentration this low

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

Energy Fuels Nuclear
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET

Time Received: Date: 5/2/88 By: Gina Reichert Via: Airplane

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Fluoride	1	340.2	5 mg/l	3	A. Knudson	5/16/88
Conductance	1	120.0	0.1 mhos/cm	3	P. Huebner	5/16/88
Chloride	1	325.3	0.2 mg/l	3	D. Hobbs	5/16/88
Selenium	1	270.2	2 µg/l	1	T. Carr	5/13/88
Phosphate	1	365.1	0.01 mg/l	3	D. Hobbs	5/17/88
pH	1	150.1	0.01 units	3	P. Huebner	5/17/88
Alkalinity	1	310.1	0.5 mg/l	3	P. Huebner	5/17/88
Barium	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Cadmium	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Calcium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Chromium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Copper	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Iron	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Lead	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Magnesium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Manganese	1	200.7	3 µg/l	1	J. Hageman	5/18/88
Potassium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Ammonia	1	350.1	0.1 mg/l	3	D. Hobbs	5/3/88
Mercury	1	245.1	0.2 µg/l	1	G. Gilleland	5/12/88
Arsenic	1	206.2	1 µg/l	1	T. Carr	5/23/88
Silica	1	200.7	10 µg/l	1	J. Hageman	5/23/88
Silver	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Sodium	1	200.7	0.01 µg/l	1	J. Hageman	5/18/88
Zinc	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Total Suspended Solids	1	160.2	4 mg/l	3	R. Lovell	5/17/88

200.7ICP-AES
emmission spectrometry

Approved by

BARRINGER LABORATORIES INC.

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SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Total Dissolved Solids	1	160.1	10 mg/l	3	R. Lovell	5/19/88
Sulfate	1	375.3	0.1 mg/l	3	R. Lovell	5/19/88
Alpha-Beta	4		1.0,2.0 pCi/l	3	J. Ortiz	5/13-5/23/88
Lead 210	5		1.0 pCi/l	3	M. Kidwell	5/9-5/25/88
Polonium 210	6		1.0 pCi/l	3	J. Ortiz	5/11-5/12/88
Radium 226	4,7		0.2 pCi/l	3	M. Howard	5/9-5/18/88
Radium 228	12,13,14		0.9 pCi/l	3	K. Goodale	5/17-5/27/88
Thorium 230	11		0.2 pCi/l	3	Taylor & Ortiz	5/11-5/16/88
Uranium	9,10		0.2 pCi/l	3	B. Tonning	5/10-5/12/88

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HR012	Fluoride	1.49	1.49	3.4%
HR012	Conductance	3370	3480	3.2%
PN011 Pinenut	Chloride	16	16	0.0%
HR012	Selenium	0.009	0.008	11.0%
PN011	Phosphate	<0.1	<0.1	0.0%
HR012	pH	7.99	8.04	0.6%
HR012	Alkalinity	159	159	0.0%
PN011	Ammonia	<0.1	<0.1	0.0%
HR012	Silver	<0.01	<0.01	0.0%
HR012	Sodium	0.23	0.24	4.3%
HR012	Zinc	0.011	0.011	0.0%
HR012	Total Dissolved Solids	3510	3500	0.4%
HR012	Total Suspended Solids	17	19	11.0%
HR012	Sulfate	2230	2230	0.0%

Approved by _____

BARRINGER LABORATORIES INC.

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SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

Uranium is the highest alpha decay - it is not possible to have these high of Ra 226, Ra 228 and Th 230 and only have 34 pCi/L of U. But these uranium results are just a copy of the Lab Accuracy results for Barringer Labs and the value is for dissolved U concentration in ppb, not U alpha decay

QUALITY CONTROL DATA SHEET (cont'd)

These are the spiked Lab Accuracy testing samples

No sample ID

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Fluoride	0.51	0.50	0.45 - 0.55	2.0%	102
Chloride	26.5	25.85	22.3 - 28.7	2.4%	98
Selenium	0.009	0.009	0.006 - 0.012	0.0%	104
Phosphate	0.47	0.50	0.46 - 0.54	6.2%	---
Barium	0.98	0.97	0.82 - 1.12	1.0%	97
Cadmium	0.098	0.094	0.080 - 0.108	4.0%	103
Calcium	250	250	214 - 288	0.0%	101
Chromium	0.100	0.103	0.088 - 0.118	3.0%	103
Copper	0.105	0.103	0.088 - 0.118	2.0%	102
Iron	0.096	0.102	0.087 - 0.117	6.0%	110
Lead	0.106	0.101	0.086 - 0.116	5.0%	105
Magensium	0.103	0.100	0.085 - 0.115	3.0%	97
Manganese	0.104	10.02	0.087 - 0.117	2.0%	105
Potassium	9.84	10.0	8.5 - 11.5	1.6%	103
Ammonia	2.00	1.98	1.78 - 2.18	1.0%	97
Merucry	0.005	0.005	0.003 - 0.006	0.0%	75
Arsenic	0.099	0.100	0.080 - 0.118	1.0%	80
Silica	1.20	1.07	0.91 - 1.23	13.0%	119
Silver	0.97	0.99	0.84 - 1.14	2.0%	98
Sodium	0.80	0.86	0.73 - 0.99	6.0%	92
Zinc	0.106	0.101	0.086 - 0.116	5.0%	114
Total Dissolved Solids	1479	1479	1331 - 1627	0.0%	---
Sulfate	1030	1000	900 - 1100	3.0%	---
Gross Alpha	198 ± 6	198	178 - 218 *MCL= 20 pCi/L*	0.0%	---
Gross Beta	108 ± 2	104	94 - 114	3.7%	---
?! Lead 210	112 ± 1	112	106 - 118	0.0%	---
Polonium 210	109	112	106 - 118	2.7%	---
Radium 226	104 ± 3	101	96 - 106	3.0%	---
Radium 228	40 ± 2	40	38 - 42	0.0%	---
Thorium 230	97 ± 3	99	94 - 104	2.1%	---
Uranium	32	34 *ppb not pCi/L*	32 - 36 *MCL = 30 ppb*	5.9%	---

Same results as page 283

Approved by

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

Client No. Log No. 8106 Client PO No.

Sample Type: water Canyon Mine

Date Collected: 4/28-4/29/88 Date Received: 5/2/88 Date Reported: 6/28/88

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l	As Total mg/l
CN013	216	208	8.2	<0.1	<0.001

Sample Identification	Ba Total mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance µmho/cm
CN013	0.10	<0.005	44.4	7.0	0.03	435

Sample Identification	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
CN013	<0.01	0.36	0.25	<0.02	30.4	0.04	0.0014

Sample Identification	NO_3 as N mg/l	pH units	PO_4 mg/l	K Total mg/l	Se Total mg/l	SiO_2 mg/l	Ag Total mg/l
CN013	0.1	8.52	<0.1	2.46	0.003	11.4	<0.01

Approved by _____

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
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PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

Sample Identification	Na Total mg/l	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l	Pb-210 Total pCi/l ±Precision*
CN013	5.64	214	<4	18	0.035	0.0 ± 0.7

Sample Identification	Gross Alpha Total pCi/l ±Precision*	Gross Beta Total pCi/l ±Precision*	Po-210 Total pCi/l ±Precision*	Ra-226 Total pCi/l ±Precision*
CN013	16 ± 5	5.9 ± 2.0	0.9 ± 0.5	1.7 ± 0.5

Sample Identification	Ra-228 Total pCi/l ±Precision*	Th-230 Total pCi/l ±Precision*	U Total mg/l
CN013	0.2 ± 1.2	0.1 ± 0.4	0.0175

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by

BARRINGER LABORATORIES INC.

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GOLDEN, COLORADO 80401
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SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET

Time Received: Date: 5/2/88 By: Gina Reichert Via: Airplane

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Fluoride	1	340.2	0.1 mg/l	3	A. Knudson	5/16/88
Conductance	1	120.0	0.1 µmhos/cm	3	P. Huebner	5/16/88
Chloride	1	325.3	0.2 mg/l	3	D. Hobbs	5/16/88
Selenium	1	270.2	2 µg/l	1	T. Carr	5/13/88
Phosphate	1	365.1	0.01 mg/l	3	D. Hobbs	5/17/88
pH	1	150.1	0.01 units	3	P. Huebner	5/17/88
Alkalinity	1	310.1	0.5 mg/l	3	P. Huebner	5/17/88
Barium	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Cadmium	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Calcium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Chromium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Copper	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Iron	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Lead	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Magensium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Manganese	1	200.7	3 µg/l	1	J. Hageman	5/18/88
Potassium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Ammonia	1	350.1	0.1 mg/l	3	D. Hobbs	5/3/88
Mercury	1	245.1	0.2 µg/l	1	G. Gilleland	5/12/88
Arsenic	1	206.2	1 µg/l	1	T. Carr	5/23/88
Silica	1	200.7	10 µg/l	1	J. Hageman	5/23/88
Silver	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Sodium	1	200.7	0.01 µg/l	1	J. Hageman	5/18/88
Zinc	1	200.7	5 µg/l	1	J. Hageman	5/18/88

Approved by _____

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Total Suspended Solids	1	160.2	4 mg/l	3	R. Lovell	5/17/88
Total Dissolved Solids	1	160.1	10 mg/l	3	R. Lovell	5/19/88
Sulfate	1	375.3	0.1 mg/l	3	R. Lovell	5/19/88
Alpha-Beta	4		1.0,2.0 pCi/l	3	J. Ortiz	5/13-5/23/88
Lead 210	5		1.0 pCi/l	3	M. Kidwell	5/9-5/25/88
Polonium 210	6		1.0 pCi/l	3	J. Ortiz	5/11-5/12/88
Radium 226	4,7		0.2 pCi/l	3	M. Howard	5/9-5/18/88
Radium 228	12,13,14		0.9 pCi/l	3	K. Goodale	5/17-5/27/88
Thorium 230	11		0.2 pCi/l	3	Taylor & Ortiz	5/11-5/16/88
Uranium	9,10		0.2 pCi/l	3	B. Tonning	5/10-5/12/88

QUALITY CONTROL STANDARDS

The "known" is from the Lab Accuracy testing, these are not new samples

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Fluoride	0.51	0.50	0.45 - 0.55	2.0%	102
Chloride	26.5	25.85	22.3 - 28.7	2.4%	98
Selenium	0.009	0.009	0.006 - 0.012	0.0%	104
Phosphate	0.47	0.50	0.46 - 0.54	6.2%	---
Barium	0.98	0.97	0.82 - 1.12	1.0%	97
Cadmium	0.098	0.094	0.080 - 0.108	4.0%	103
Calcium	250	250	214 - 288	0.0%	101
Chromium	0.100	0.103	0.088 - 0.118	3.0%	103
Copper	0.105	0.103	0.088 - 0.118	2.0%	102
Iron	0.096	0.102	0.087 - 0.117	5.0%	110
Lead	0.106	0.101	0.086 - 0.116	5.0%	105
Magnesium	0.103	0.100	0.085 - 0.115	3.0%	97

Approved by _____

BARRINGER LABORATORIES INC.

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GOLDEN, COLORADO 80401
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Energy Fuels
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

Same results as pages

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS (cont'd)

No sample ID - not a new sample

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Manganese	0.104	0.102	0.087 - 0.117	2.0%	105
Potassium	9.84	10.0	8.5 - 11.5	1.6%	103
Ammonia	2.00	1.98	1.78 - 2.18	1.0%	97
Mercury	0.005	0.005	0.003 - 0.006	0.0%	75
Arsenic	0.099	0.100	0.080 - 0.118	1.0%	80
Silica	1.20	1.07	0.91 - 1.23	13.0%	119
Silver	0.97	0.99	0.84 - 1.14	2.0%	98
Sodium	0.80	0.86	0.73 - 0.99	6.0%	92
Zinc	0.106	0.101	0.086 - 0.116	5.0%	114
Total Dissolved Solids	1479	1479	1331 - 1627	0.0%	---
Sulfate	1030	1000	900 - 1100	3.0%	---
Gross Alpha	198 ± 6	198	178 - 218	0.0%	---
Gross Beta	108 ± 2	104	94 - 104	3.7%	---
??? Lead 210	112 ± 1	112	106 - 118	0.0%	---
Polonium 210	109	112	106 - 118	2.7%	---
Radium 226	104 ± 3	101	96 - 106	3.0%	---
Radium 228	40 ± 2	40	38 - 42	0.0%	---
Thorium 230	97 ± 3	99	94 - 104	2.1%	---
Uranium	32	34	32 - 36	5.9%	---

These alpha and beta results are just not possible

Same results on pages as page 278

Approved by _____

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

EVAN MECHAM, GOVERNOR
GERALD H. TELETZKE, PH.D., DIRECTOR

January 25, 1988

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202
Attn: Brad L. Doores, Vice President
Legal and Regulatory Affairs

Dear Sir:

Re: Groundwater Quality Protection Permit No. G-0035-08
Hermit Mine

Enclosed is a signed copy of the Groundwater Quality Protection Permit for the above referenced facility. This permit was developed pursuant to A.A.C. Title 9, Chapter 21, Arizona Groundwater Quality Standards; A.A.C. Title 9, Chapter 20, Article 2, Requirements for Facilities Affecting Groundwater Quality.

If you have any questions regarding this permit, please feel free to contact this office at 257-2270.

Sincerely,

Gerri Plain
Water Permits Unit
Office of Water Quality

cc: Compliance Unit (John Rampe)
Robert Hollander (Central Regional Office)
County Health Department (Mohave)
HS-Lab Licensure Prg. Mg.
Roger Smith, Energy Fuel Nuclear, Inc.

STATE OF ARIZONA

GROUNDWATER QUALITY PROTECTION PERMIT

Part I. AUTHORIZATION FOR FACILITY OPERATION SUCH THAT GROUNDWATER QUALITY OF THE STATE OF ARIZONA IS NOT ADVERSELY IMPACTED.

In compliance with the provisions of A.R.S. 36-1851 et seq; A.A.C. Title 9, Chapter 20, Article 2; A.A.C. Title 9, Chapter 21, Article 2; and conditions set forth in this permit:

Facility Name:	Operator:
Hermit Mine	Energy Fuels Nuclear, Inc. One Tabor Center, Suite 2500 1200 Seventeenth Street Denver, Colorado 80202

is authorized to operate the Hermit Mine, an underground uranium mine located approximately 21 miles south of Fredonia, Arizona in Mohave County over the groundwaters of Kanab Plateau Basin in Township 38 North; Range 4 West; Section 17, W 1/2 SW 1/4 - Gila and Salt River Base Line and Meridian.

This permit shall become effective on the date of signature and shall be valid for 15 years provided that the facility is operated and maintained in compliance with the specific conditions, general conditions, and information documented or referenced in Parts I, II, III and IV of this Permit and such that groundwater quality standards are not violated (Part V).

Brad L. Doores

Brad L. Doores, Vice President
Legal and Regulatory Affairs
Energy Fuels Nuclear, Inc.

Signed this 8th day of January 19 88

Ronald L. Miller

Ronald L. Miller, Ph.D., Assistant Director
Arizona Department of Environmental Quality

Signed this 29th day of December 19 87

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

EVAN MECHAM, GOVERNOR
GERALD H. TELETZKE, PH.D., DIRECTOR

January 4, 1988

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202
Attn: Brad L. Doores, Vice President
Legal and Regulatory Affairs

Dear Sir:

RE: Hermit Mine
Groundwater Quality Protection Permit No. G-0035-08

Enclosed is the signed original of the Groundwater Quality Protection Permit for the above referenced facility. This permit was developed pursuant to A.A.C. Title 9, Chapter 20, Article 4, Arizona Groundwater Quality Standards and A.A.C. Title 9, Chapter 20, Article 2, Requirements for Facilities Affecting Groundwater Quality.

It is deemed necessary for the owner of the facility to sign the Groundwater Quality Protection Permit and return the entire permit within ten (10) working days, so that the permit may become valid. A copy of the permit will be returned. The permit shall be signed as follows:

1. For a corporation, by a responsible corporate executive at the level of at least vice president of the firm, or the manager of its Arizona operation if a multi-state operation;
2. For a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or,
3. For a municipality, state federal or other public agency, by either a principal executive officer or ranking elected official.

Any comments or corrections should be indicated on a separate paper. Please do not make any corrections or other comments on the permit.

If you have any questions regarding this permit, please feel free to contact this office at 257-2270.

Sincerely,

Gerri Plain
Water Permits Unit
Office of Water Quality

The Department of Environmental Quality is An Equal Opportunity/Affirmative Action Employer

4th Quarter 1988

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561

March 7, 1989



Mr. Miguel Santiago
Environmental Health Specialist
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine Groundwater Protection Permit No. G-0035-08

Dear Mr. Santiago:

Enclosed please find Fourth Quarter analytical results from the Hermit Mine monitor well. The well was sampled on December 22, 1988 and sample analysis is identified as HR032. Also attached are analysis results taken from a water producing zone within the Hermit shaft sampled on December 23, 1988.

Shaft water analysis is identified as Sample Identification Number HR033. Water was collected at a point approximately 908 feet below shaft collar elevation (3976 MSL) in a zone yielding an estimated 14 gpm. The water bearing zone is just above the contact between the Hermit shale and Coconino sandstone.

If you have questions concerning this matter, please contact me at our Denver office.

908' bls/3,976' amsl is at the base of the Toroweap Formation, just above the contact with the Coconino Sandstone - See Hermit Mine Shaft Closure Plan, 1990 - the monitor well sample may not have been collected from the R/M monitor water/monitor well (55-518877) Compare concentration to the septic water

Sincerely,

William J. Almas/smm

William J. Almas
Environmental Coordinator

WJA:smm

Enclosures

BARRINGER LABORATORIES INC.

18000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358 1168

Engery Fuels Nuclear, Inc.
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. | Log No. 9382 | Client PO No.

Sample Type: water

Date Collected: 12/21-27/88 | Date Received: 1/9/89 | Date Reported: 1/30/89

RESULTS OF ANALYSIS

carbonate and bicarbonate are not the same thing

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l
WS030 ?	85	85	<1	<.1
PN031	201	201	<1	.1
HR032 well	157	157	<1	.1
HR033 shaft	223	223	<1	.1
LC034 Fredonia office	224	224	<1	.1
CN035 Canyon Mine	215	215	<1	<.1

Sample Identification	As Total mg/l	Ba Total mg/l	B mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l
WS030	.003	.03	.16	<.005	447	47.9
PN031	.003	.04	.21	<.005	193	20.9
HR032 well	.006	.04	.16	<.005	533	40.1
HR033 shaft	.011	.06	.19	<.005	545	31.1
LC034	.011	.04	.19	<.005	516	31.1
CN035	<.001	.12	<.01	<.005	40.7	8.0

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

Sample Identification	Cr Total mg/l	Conductance umho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l
WS030	<.01	3200	.03	.87	.43
PN031	<.01	2030	.03	.83	10.8
HR032 well shaft	.01	3440	.04	1.41	7.33
HR033	.01	3310	.04	1.24	.92
LC034	.01	3650	.03	1.23	.94
CN035	<.01	494	.01	.34	.46

Sample Identification	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l
WS030	<.02	195	.02	.0015	.01
PN031	<.02	129	.57	.0007	.04
HR032 well shaft	<.02	177	.10	<.0002	.01
HR033	<.02	174	.04	.0006	.01
LC034	<.02	164	.04	<.0002	.01
CN035	<.02	28.8	.03	.0004	<.01

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
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(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

Sample Identification	NO_3 as N mg/l	PO_4 Total mg/l	pH units	K Total mg/l	Se Total mg/l
WS030	1.4	<.1	7.74	12.2	.049
PN031	<1.0	<.1	7.70	31.0	.005
HR032 well	<1.0	<.1	7.40	21.6	.012
HR033 shaft	<1.0	<.1	7.36	32.3	.014
LC034	<1.0	<.1	7.40	30.4	.013
CN035	<1.0	<.1	7.86	2.2	<.001

Sample Identification	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	TSS mg/l	SO_4 mg/l
WS030	12.4	<.01	55.8	3100	<4	2010
PN031	8.7	.01	81.7	1580	42	986
HR032 well	12.6	<.01	73.6	3430	9	2220
HR033 shaft	9.6	<.01	107	3200	<4	2080
LC034	10.2	<.01	100	3220	<4	2080
CN035	9.7	<.01	6.00	232	7	16

Approved by KL, St

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

Sample Identification	SO_3 mg/l	Zn Total mg/l	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*
WS030 ?	<5	.097	17 ± 17	66 ± 11
PN031 Pigeon	<5	.059	94 ± 16	57 ± 6
HR032 well shaft Hermit	<5	.136	12 ± 18	30 ± 10
HR033	<5	.134	1500 ± 100	370 ± 20
LC034 Fredonia office	<5	.122	1400 ± 100	390 ± 20
CN035 Canyon	<5	.123	17 ± 4	10 ± 2

Gross alpha can't be lower than gross beta

Sample Identification	Ra-226 (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
WS030	0.2 ± 0.2	0.5 ± 0.6	0.0185
PN031	17 ± 1	0.9 ± 0.7	0.0024
HR032 well shaft	2.1 ± 0.5	0.6 ± 0.6	0.0024
HR033	162 ± 4	0.1 ± 0.5	0.0207
LC034	178 ± 4	0.1 ± 0.5	0.0228
CN035	2.9 ± 0.6	0.3 ± 0.5	0.0183

0.0183 mg/L is a reasonable concentration for 17 ± 4 pCi/L

Too low for 1500 & 1400 pCi/L and the higher alpha should be the higher concentration

2.28 and 2.07 mg/L makes more sense

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2 σ

Approved by Susan K Pinkley

Why approved by a

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

QUALITY CONTROL DATA SHEET

Not who signed USPS cerified receipt

Time Received: 9:30 Date: 1/9/89 By: Gina Reichert Via: UPS ?

Receipt on page 298 is dated 1/8/1888

Sample Container Type: large cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. none 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	0.5 mg/l	3	J. Hageman	1/11/89
Chloride	1	325.2	0.2 mg/l	3	D. Hobbs	1/12/89
Ammonia	1	350.1	0.1 mg/l	2	D. Hobbs	1/12/89
Phosphate	1	365.1	0.01 mg/l	3	D. Hobbs	1/13/89
Nitrate	1	353.1	0.1 mg/l	2	D. Hobbs	1/13/89
Conductivity	1	120.1	0.1 umhos/cm	3	A. Knudson	1/26/89
Fluoride	1	340.2	0.1 mg/l	3	A. Knudson	1/16/89
pH	1	150.1	0.01 units	3	A. Knudson	1/16/89
Mercury	1	245.1	0.2 ug/l	1	J. Hageman	1/20/89
Barium	1	200.7	5 ug/l	1	D. Hidalgo	1/24/89
Boron	1	200.7	10 ug/l	1	D. Hidalgo	1/24/89
Cadmium	1	200.7	5 ug/l	1	D. Hidalgo	1/24/89
Calcium	1	200.7	10 ug/l	1	D. Hidalgo	1/24/89
Chromium	1	200.7	10 ug/l	1	D. Hidalgo	1/24/89
Copper	1	200.7	10 ug/l	1	D. Hidalgo	1/24/89
Iron	1	200.7	10 ug/l	1	D. Hidalgo	1/24/89
Lead	1	200.7	5 ug/l	1	D. Hidalgo	1/24/89
Magnesium	1	200.7	10 ug/l	1	D. Hidlago	1/24/89
Manganese	1	200.7	3 ug/l	1	D. Hidlago	1/24/89
Molybdenum	1	200.7	10 ug/l	1	D. Hidlago	1/24/89
Arsenic	1	206.2	1 ug/l	1	G. Gilleland	1/25/89
Sulfate	1	375.3	0.1 mg/l	3	A. Meyer	1/11/89
TDS	1	160.1	10 mg/l	3	A. Knudson	1/26/89

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
TSS	1	160.2	4 mg/l	3	A. Meyer	1/12/89
Selenium	1	270.2	2 ug/l	1	D. Hobbs	1/18/89
Sulfide	1	376.2	1 mg/l	3	A. Knudson	1/18/89
Potassium	1	200.7	10 ug/l	1	D. Hidalgo	1/24/89
Silver	1	200.7	5 ug/l	1	D. Hidalgo	1/24/89
Sodium	1	200.7	0.01 ug/l	1	D. Hidalgo	1/24/89
Zinc	1	200.7	5 ug/l	1	D. Hidalgo	1/24/89
Silica	1	200.7	10 ug/l	1	D. Hidalgo	1/24/89
Alpha-Beta	4		1.0,2.0 pCi/l	3	M. Kidwell	1/10-2/6/89
Radium 226	4,7		0.2 pCi/l	3	Goodale,Howard	1/16-1/18/89
Thorium 230	11		0.2 pCi/l	3	J. Ortiz	1/18-1/25/89
Uranium	4,14		0.3 ug/l	3	B. Tonning	1/18-1/20/89

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
S030	Alkalinity	85	84	1.2%
N035	Chloride	8.0	8.0	0.0%
N035	Ammonia	<.1	<.1	0.0%
N035	Phosphate	<.1	<.1	0.0%
N035	Nitrate	<1.0	<1.0	0.0%
S030	Fluoride	.87	.87	0.0%
R033	pH	7.36	7.36	0.0%
M035	Barium	.12	.11	10.0%
M035	Boron	<.01	<.01	0.0%
M035	Cadmium	<.005	<.005	0.0%
M035	Calcium	40.7	41.4	1.7%

Approved by _____

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(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification		Parameter	Result	Result	Relative Deviation From Mean
CN035	Canyon Mine	Chromium	<.01	<.01	0.0%
CN035		Copper	.01	<.01	---
CN035		Iron	.46	.40	12.0%
CN035		Lead	<.02	<.02	0.0%
CN035		Magnesium	28.8	29.4	2.0%
CN035		Manganese	.03	.03	0.0%
CN038		Molybdenum	<.01	<.01	0.0%
HR032	Hermit well	Arsenic	.006	.006	0.0%
CN035		Sulfate	15	17	12.5%
LC034		TDS	3220	3220	0.0%
HR032		TSS	10	8	22.0%
CN035		Selenium	<.001	<.001	0.0%
HR033	shaft	Sulfide	<5	<5	0.0%
CN035		Potassium	2.2	2.2	0.0%
CN035		Silver	<.01	<.01	0.0%
CN035		Sodium	6.00	5.91	1.5%
CN035		Zinc	.123	.116	5.7%
CN035		Silica	9.70	9.61	0.9%
CN035		Uranium	0.0188	0.0178	2.7%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known
Chloride	24.7	26.05	24.1 - 27.7	5.3%
Ammonia	2.00	1.98	1.78 - 2.18	1.0%
Phosphate	.51	.50	.46 - .54	2.0%

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS (cont'd)

No sample IDs

There should not be a known if these are new samples

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known
Nitrate	2.06	1.98	1.78 - 2.18	4.0%
Fluoride	.52	.50	.45 - .55	3.9%
Mercury	.005	.005	.004 - .006	0.0%
Barium	1.01	.97	.82 - 1.12	4.0%
Boron	.94	.99	.84 - 1.14	5.0%
Cadmium	.219	.200	.170 - .230	9.5%
Calcium	.209	.200	.170 - .230	4.5%
Chromium	.206	.200	.170 - .230	3.0%
Copper	.198	.200	.170 - .230	1.0%
Iron	.209	.200	.170 - .230	4.5%
Lead	.211	.200	.170 - .230	5.5%
Magnesium	.218	.200	.170 - .230	9.0%
Manganese	.206	.200	.170 - .230	3.0%
Molybdenum	.206	.200	.170 - .230	3.0%
Arsenic	.069	.062	.048 - .073	11.0%
Sulfate	1012	1000	900 - 1100	1.2%
TDS	1472	1479	1331 - 1627	0.4%
Selenium	.024	.025	.017 - .028	4.1%
Potassium	10.1	10.0	8.5 - 11.5	1.0%
Silver	1.06	.99	.84 - 1.14	7.0%
Sodium	.83	.86	.73 - .99	3.0%
Zinc	.206	.200	.170 - .230	3.0%
Silica	1.14	1.07	.91 - 1.23	7.0%
Gross Alpha	110 ± 4	110	99 - 121	0.0%
Gross Beta	177 ± 2	175	158 - 193	1.1%
Radium 226	105 ± 3	101	96 - 106	4.0%
Thorium 230	87 ± 2	99	94 - 104	12.1%
Uranium	33	34	32 - 36	2.9%

Approved by Susan K Barbuy

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

QUALITY CONTROL DATA SHEET (cont'd)

SPIKES

What sample?

Parameter	Spike % Recovery	Parameter	Spike % Recovery
Ammonia	106	Phosphate	100
Nitrate	103	Fluoride	93
Barium	98	Cadmium	91
Chormium	96	Copper	86
Iron	102	Lead	100
Manganese	98	Molybdenum	100
Arsenic	112	Potassium	94
Silver	93	Sodium	102
Zinc	100		

Approved by M.J.K

RE: Hermit Mine G-0035-08 **Not stamped**

SENDER: Complete items 1 and 2 when additional services are desired, and complete i[illegible]3 and 4.

Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will preven[illegible]is card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *↑(Extra charge)↑*
2. ☐ Restricted Delivery *↑(Extra charge)↑*

3. Article Addressed to:

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202
Attn: Brad L. Doores
Vice President

4. Article Number
137993

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Addressee
X R C Mendoza

6. Signature — Agent
X

7. Date of Delivery
1-8-08

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form **3811**, Mar. 1987 ★ U.S.G.P.O. 1987-178-268 **DOMESTIC RETURN RECEIPT**

R6W R5W R4W R3W R2W R1W

T 41 N
T 40 N
T 39 N
T 38 N
T 37 N
T 36 N
T 35 N
T 34 N

Colorado City
Fredonia
KAIBAB INDIAN RESERVATION
Moccasin Mountains
Sheep Valley
Mt. Trumbull Road
Hermit Project Site
Access Road
Area of Operations
EXISTING POWERLINE
12.5 Miles
6 Miles
8.5 Miles
13.25 Miles
PIGEON
KANAB NORTH
HACK 1,2&3
PINENUT
GRAND CANYON NATIONAL GAME PRESERVE
GRAND CANYON NATIONAL PARK
Kanab Plateau
Johnson Wash
Pipe Springs National Monument
Landing Strip
Powerline
Pipe Valley
Antelope Valley
Wild Band Wash
Sandridge Wash
Yellowstone Mesa
Big Mesa
Buckskin Mountains
Cliffs
Canyon
Point
Wash
Spring

Scale: 1:100,000

REFERENCES	REVISIONS NO.	DESCRIPTION	BY	CH.	APPROVED	DATE

	BY	DATE
DESIGNED	S.A.	
DRAWN	K.H.	2/87
CHECKED		
APPROVED 1		
APPROVED 2		
APPROVED 3		

energy fuels nuclear, inc.

PROJECT **HERMIT**

TITLE PROJECT LOCATION MAP

SCALE 1": 1.5miles | DWG. NO. HM-AA5-04 | PLATE 1

E 792,000

E 793,000

E 794,000

E 795,000

N 2,073,000

N 2,072,000

4906.2

4904.0

4880

4885

4890

4895

4900

4905

MINE ACCESS ROAD

EXISTING ACCESS ROAD

EVAPORATION POND
(Bottom Elev. 4875')

WASTE DISPOSAL AREA

WASTE DISPOSAL AREA

AREA OF OPERATIONS

FUEL STORAGE
W/Berm

SHAFT
HEADFRAME

HOIST HOUSE

4885.80

UNDISTURBED AREA

WATER WELL

TEMPORARY TRAILERS

SUB-STATION

SEPTIC FIELD

Topsoil Stockpile

EXISTING ACCESS ROAD

PREVAILING WIND DIRECTION

18 | 17
19 | 20

-KEY-

- AREA OF OPERATIONS
- WASTE DISPOSAL
- TOPSOIL STORAGE
- SHAFTS (Production & Vent)
- BUILDINGS & FENCES (as noted)
- ELECTRIC POWERLINE
- DIRECTION OF DRAINAGE FLOW

REFERENCES

REVISIONS NO.	DESCRIPTION	BY	CH.	APPROVED	DATE

	BY	DATE
DESIGNED	S.A.	
DRAWN	K.H.	2/87
CHECKED		
APPROVED 1		
APPROVED 2		
APPROVED 3		

energy fuels nuclear, inc.

PROJECT **HERMIT** #100299

TITLE

SITE FACILITIES LAYOUT

Site Preparation & Shaft Sinking Phase

SCALE	DWG. NO.	
1": 100'	HM-AA5-08	PLATE 2

E 792,000

E 793,000

E 794,000

E 795,000

N 2,073,000

N 2,072,000

4880

4885

4890

4895

4900

4905

4906.2

4904.0

4885.80

MINE ACCESS ROAD

RECLAIMED EXISTING ACCESS ROAD

RECLAIMED EXISTING ACCESS ROAD (To Be Reclaimed During Development Phase)

CULVERT

EVAPORATION POND (Bottom Elev. 4875')

WASTE DISPOSAL AREA

WASTE DISPOSAL AREA

AREA OF OPERATIONS

Topsoil Stockpile

HIGH GRADE STOCKPILE

LOW GRADE STOCKPILE

FUEL STORAGE W/Berm

VENT SHAFT

SHAFT

HEADFRAME

MAIN BUILDING

HOIST HOUSE

WAREHOUSE

SHOP

WATER WELL

OFFICE/DRY CHANGE HOUSE

SUB-STATION

Topsoil Stockpile

SEPTIC FIELD

DRAINAGE

PREVAILING WIND DIRECTION

18 17
19 20

-KEY-

- AREA OF OPERATIONS
- ORE STOCKPILE
- WASTE DISPOSAL
- TOPSOIL STORAGE
- SHAFTS (Production & Vent)
- BUILDINGS & FENCES (as noted)
- ELECTRIC POWERLINE
- DIRECTION OF DRAINAGE FLOW

REFERENCES

REVISIONS NO.	DESCRIPTION	BY	CH.	APPROVED	DATE

	BY	DATE
DESIGNED	S.A.	
DRAWN	K.H.	2/87
CHECKED		
APPROVED 1		
APPROVED 2		
APPROVED 3		

energy fuels nuclear, inc.

PROJECT **HERMIT** #100299

TITLE SITE FACILITIES LAYOUT

Development & Mining Phase

SCALE 1": 100'

DWG. NO. HM-AA5-07

PLATE 3

E 792,000

E 793,000

E 794,000

E 795,000

N 2,073,000

N 2,072,000

ACCESS ROAD

4880

4885

4890

4895

4900

4905

4906.2

4904.0

Original Area
Of Operations

Sealed Shaft

Sealed Vent

5
4885.80

POWERLINE

DRAINAGE

: Direction of Flow

18 17
19 20

REFERENCES

NO.	DESCRIPTION	BY	CH.	APPROVED	DATE

REVISIONS

	BY	DATE
DESIGNED	S.A.	
DRAWN	K.H.	2/87
CHECKED		
APPROVED 1		
APPROVED 2		
APPROVED 3		

energy fuels nuclear, inc.

PROJECT **HERMIT** #100299

TITLE
POST MINING
TOPOGRAPHY

SCALE 1": 100'

DWG. NO. HMAA5-09

PLATE 4

File Divider Page

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

ROSE MOFFORD, GOVERNOR
RANDOLPH WOOD, DIRECTOR

Northern Regional Office
OFFICE OF WATER QUALITY
2501 N. 4th St., Ste. 14
Flagstaff, Arizona 86004
Phone No: (602) 779-0313

APR 1990
WATER PERMITS UNIT

April 3, 1990

CERTIFIED MAIL - RETURN RECEIPT
P 853 454 390

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth St.
Denver, CO 80202
Attention: Brad L. Doores, Vice President, Legal & Regulatory Affairs

Re: Sanitary Survey of Energy Fuels Nuclear, Pinenut Mine, Groundwater Quality Protection Permit No. G-0036-08, Mohave County

Enclosed is a copy of an inspection report prepared by the Northern Regional Office staff concerning the referenced facility. The inspection was performed in accordance with Arizona Revised Statutes (A.R.S.) 49-351 et seq. and with the Arizona Administration Code (A.A.C.) R18-4-267 or R18-9-809.

Your attention is directed to the Summary of Inspection section which lists the major deficiencies that were found and the necessary corrective actions. These major deficiencies are considered to be a potential threat to public health and welfare. It is necessary to correct the major deficiencies within sixty (60) days in order to protect the health of the users of the system. Please notify this office as soon as the deficiencies are corrected. Follow-up inspections will be scheduled to determine and/or confirm that deficiencies no longer exist.

Should sixty (60) days be an unreasonable time to correct the major deficiencies, please submit a proposed schedule for remedial actions. If the major deficiencies are not corrected, it will be necessary to refer this matter to the Compliance Office of the Office of Water Quality in Phoenix for further action. Such action may include an Administrative Order and fines, depending on the type of project. It is hoped to avoid this enforcement situation, if at all possible.

Under the category of Physical Facilities, "Minor Deficiencies", which are not considered to be major in their effect on quality or quantity, may be listed. The corrective actions listed for these deficiencies are recommended.

If you have any questions on this matter, please contact Buck Olberding of our Office at 779-0313.

Very truly yours,

Harley R. Hiett, P.E., Manager
Northern Regional Office
Office of Water Quality

HRH:REO:cpp
Enclosure
cc: Roger Smith, P. O. Box 36, Fredonia, AZ 86022
Water Pollution Compliance Unit, ADEQ

cc: Mohave County Health Dept.
Water Permits Unit, ADEQ

DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF WATER QUALITY

SUMMARY OF INSPECTION WASTEWATER

NPDES No. _____

Facility: Energy Fuels Nuclear - Pinenut Mine Groundwater System No. G-0036-08

Inspected by: Buck Olberding Date: 3/6/90

Accompanied by: Larry Casebolt County: Mohave

Recommendations by: Buck Olberding Date: 3/20/90

SUMMARY:	YES	NO	NA
1. Wastewater system meets State of Arizona's major requirements (Summary of Items 1-6).....	___	X	___
2. A certified operator is employed by the owner as required by State of Arizona's regulations.....	___	___	X
3. Physical facilities meet State of Arizona's requirements (Excluding Items in #6).....	___	___	X
4. Effluent quality and disposal meets State of Arizona's and EPA standards.....	___	___	X
5. Monitoring meets State of Arizona's standards [a. x Process b. x NPDES].....	___	___	X
6. This system complies with the State of Arizona's requirements of the [a. ____ Reuse Permit b. x Groundwater Quality Protection Permit].....	___	X	___

SYSTEM INFORMATION:

This facility is an underground uranium mine located approximately 51 miles south of Fredonia in Mohave County over groundwaters of Kanab Plateau Basin. The operator is restricted to the disposal of mine water and runoff from a 16-acre site to a 5.3 acre-foot lined impoundment. Domestic sewage from travel trailers, office and host buildings shall be disposed into a septic tank and leach trench system approved by Mohave County Health Department.

According to Abigail Myers of the Water Permits Unit, the premining phase ambient groundwater monitoring has been performed as required. Mohave County has approved the installation of the septic system.

GROUNDWATER PROTECTION PERMIT (Item 6) - Major Deficiency

Internal site drainage shall be improved. Visually, it appeared that runoff from the mine site would occur in 2 locations during a significant precipitation event: (1) at the east side of the subgrade ore stockpile located at the southeast portion of the mine site, and (2) to the north along the west side of the impoundment.

REO:cpp

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561
fax 303-595-0930

April 2, 1990

Ms. Jean Marie Heney
Environmental Program Specialist
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine Groundwater Protection Permit #G-0035-08

Dear Ms. Heney:

As discussed with you in our telephone conversation of March 21, 1990, I have enclosed two items which should help in your review of the Hermit Mine Premining Groundwater Report and the Hermit Mine Closure Report.

As pointed out in our conversation, Exhibit #2, Hermit Mine Premining Groundwater Quality misidentified Samples HR019 and HR025 as being taken in 1989, instead of 1988. A corrected Exhibit #2 is attached reflecting these changes.

Also, a copy of test results for native clay materials to be used in shaft plugging in the Hermit Mine is attached. As can be seen in review of the results, native materials, when compacted, have coefficient's of permeability in the 10^{-8} cm/sec range. As discussed with you, no special compactive effort of clay materials will be made because of safety considerations. However, native clay materials are being dropped down the shaft, free falling over 900 feet before impacting. This represents a considerable compactive force.

If you have any questions regarding this matter, please contact me.

Sincerely,

William J. Almas
Environmental Supervisor

HR025 was collected on 8/23/99 or 9/27/88 and might be from the shaft (page 233)

WJA/pl
Enclosures

cc: R. A. Munson
R. B. Smith

RECORD OF PHONE CONVERSATIO

DATE: 3/21/90

CALL TO: Bill Almas OF: Energy Fuels Nuclear

PHONE NUMBER: 303-931-2561

CALL FROM: Jeanmarie Haney OF: ADEQ

PHONE NUMBER: 257-2117

REGARDING: Hermit Mine groundwater and shaft sampling results

SUMMARY OF DISCUSSION:

Regarding Exhibit #2 in the Premining Water Qual data report, I was confused as to which samples were used to establish premining mean + S.D. Bill said that the sample results in the table dated 6-29-89 and 9-29-89 should have been dated 6-29-88 and 9-29-88. Typo error.

Therefore, the following sample results were used to establish pre-mining mean and std deviation:

Used to establish mean + std deviation

Sample #	Collection Date
HR 012	4-28-88
HR 019	6-29-88
HR 025	9-29-88
HR 032	12-22-88
HER 041	5-31-89

— Mining began —

	Exceedances	
HER 044	Fe, Mn, U	6-29-89
HER 048	Mn, U	9-21-89
HER 051	Mn, U, Mg, K, Na, EC, Gross β	10-19-89
HER 052	Mn, Zn, U, Ca, K, Na, Gross α, Th^{230}, pH	12-07-89

Bill will send in an amended Exhibit #2 with correct dates. Mine closure is proceeding at Hermit- They've set some of the concrete bulkheads. They completed the permeability on the native clay material → he will send the results to me by early next week. EFN is expecting a reply from DEQ regarding contingency plan for gw monitoring and mine closure.

Arizona Department of Environmental Quality

Date 3/21/90

TO Abigail Myers
2nd floor 2005

FROM Jeanmarie Haney

☐ Review	☐ Per Conversation
☐ Note and see me	☐ As Requested
☐ Note and Return	☐ Necessary Action
☐ Comment	☒ Information

REMARKS:

ADEQ/STOCK 101 (4-87)

FROM Debra Daniels

TO Abbie Myers

SUBJECT Hermit Mine CUPR

DATE 2/22/90

MESSAGE

Please review and comment on enclosed closure plan/gw (can keep copy) Please inform me who is assigned thy quality rpts

RETURN TO →

SIGNED Abby

REPLY Abby- I spoke with Bill Almas at EFN in Denver today. Attached is a copy of the phone conversation record, FYI. After receiving the clay permeability test material, I will provide comments to you for forwarding to EFN.

SIGNED

DATE / /

REDIFORM 4S 472

SEND PARTS 1 AND 3 INTACT - PART 3 WILL BE RETURNED WITH REPLY.

POLY PAK (50 SETS) 4P472

RECORD OF PHONE CONVERSATI

DATE: 3/21/90

CALL TO: Bill Almas OF: Energy Fuels Nuclear

PHONE NUMBER: 303-931-2561

CALL FROM: Jeanmarie Haney OF: ADEQ

PHONE NUMBER: 257-2117

REGARDING: Hermit Mine groundwater and shaft sampling results

SUMMARY OF DISCUSSION:

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Therefore, the following sample results were used to establish pre-mining mean and std deviation:

Sample #	Collection Date
HR 012	4-28-88
HR 019	6-29-88
HR 025	9-29-88
HR 032	12-22-88
HER 041	5-31-89
- Mining began	
HER 044	6-29-89
HER 048	9-21-89
HER 051	10-19-89
HER 052	12-07-89

Used to establish mean + std deviation

Bill will send in an amended Exhibit #2 with correct dates. Mine closure is proceeding at Hermit- They've set some of the concrete bulkheads. They completed the permeability on the native clay material → he will send the results to me by early next week. EFN is expecting a reply from DEQ regarding contingency plan for gw monitoring and mine closure.

Chen Northern, Inc.

Consulting Engineers and Scientists

Denver Colorado 80203

303 744 [illegible]
303 744 0210 Facsimile

March 9, 1990

Mr. Larry Casebolt
Energy Fuels Nuclear Inc.
2555 South Highway 89A
Fredonia, Arizona 86022

Subject: Laboratory Testing

Job No. 1 198 90

Dear Mr. Casebolt:

On February 12, 1990, we received three soil samples at our Denver laboratory which were labeled "HR-1", "HR-2", and "HR-3". These samples were indicated to contain 5%, 0%, and 1% bentonite, respectively. As requested, we performed grain-size analyses and Atterberg limits tests on these samples for classification purposes, and standard compaction tests (check points only) to determine the maximum dry density of the samples at the moisture contents as received. We used this data to remold a specimen from each sample for permeability testing in the triaxial (flexible-wall) cell. These tests were performed to simulate on-site conditions as discussed with you. The results of these tests are presented on Tables I and II, enclosed.

Please feel free to call if you have any questions regarding this data, or if we can be of further assistance.

Sincerely,

CHEN-NORTHERN, INC.

Sally K. Miller

Sally K. Miller, A.E.T.
Soils Laboratory Supervisor

SKM/kaj
Rev. By: JCB
Enclosure

Bentonite is mainly smectite minerals that generally form from decomposition of volcanic ash/tuff but can also form from hydrothermal alteration of sedimentary rocks

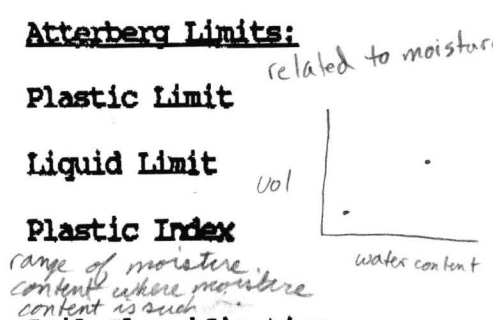
CHEN-NORTHERN, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

MARCH 6, 1990 JOB NO. 1 198 90

Percent Passing: Sieve Size	Sample No. HR-1	Sample No. HR-2	Sample No. HR-3
0.75 in.	100	100	100
0.375 in.	99	99	99
No. 4 (0.187 in.)	99	98	98
No. 8 (0.0937 in.)	94	94	96
No. 16 (0.0469 in.)	92	92	94
No. 30 (0.0232 in.)	91	90	92
No. 50 (0.0117 in.)	89	88	90
No. 100 (0.0059 in.)	83	83	85
No. 200 (0.0029 in.)	77	76	78
Atterberg Limits:			
Plastic Limit	19	18	19
Liquid Limit	38	35	35
Plastic Index	19	17	16
Soil Classification	Lean Clay with Sand	Lean Clay with Sand	Lean Clay with Sand
Moisture Content As Received, %	7.3	7.5	7.5
Maximum Dry Density, pcf, at "As Received" Moisture Content	106.2	108.0	106.9



Holtz + Kovacs: Intro to GeoTech Eng.

Schroeder: Soils in construction

CHEN-NORTHERN, INC.

TABLE II

SUMMARY OF PERMEABILITY TEST RESULTS

MARCH 6, 1990 JOB NO. 1 198 90

Sample No.	Initial Moisture Content, %	Initial Dry Density, pcf	Initial Percent Compaction, *	Final Moisture Content, %	Final Saturation, %	Final Dry Density, pcf	Confining Pressure, psi	Coefficient of Permeability, cm/sec
HR-1	7.4	105.4	99.3	20.2	99.7	109.0	80.0	2.6×10^{-8}
HR-2	6.9	108.3	100.3	18.6	97.8	111.3	80.0	7.7×10^{-8}
HR-3	6.7	106.8	99.9	19.2	94.1	108.8	80.0	5.5×10^{-8}

Initial Percent = relative compaction

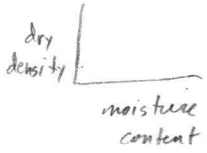
Final Saturation = degree of saturation

ASTM D6-98

Relative compaction = density in place / max dry density

* Based on Maximum Dry Density reported on Table I

40 lbs soil relnship btwn density & moisture content



max density at optimum moisture content



lowest perm assoc'd w/optimum moisture content

Density: wt / vol

Dry Density: wt solids only / vol

Total density: Dry Density x (1 + water content)

FROM Debra Daniel

RETURN TO Abigail Myers

SUBJECT Hermit Mine CUP

DATE 2/22/90

MESSAGE

Please review and comment on enclosed closure plan & gw (can keep copy) Please inform me who is assigned this Groundwater rpt

RETURN TO →

SIGNED Abby

REPLY Abby- I spoke with Bill Almas at EFN in Denver today. Attached is a copy of the phone conversation record, FYI. After receiving the clay permeability test material, I will provide comments to you for forwarding to EFN.

SIGNED

DATE / /

REDIFORM 4S 472

SEND PARTS 1 AND 3 INTACT - PART 3 WILL BE RETURNED WITH REPLY.

POLY PAK (50 SETS) 4P472

~~LANDMARK RECLAMATION~~

EFN



March 7, 1990

Ms. Abigail A. Myers
Environmental Program Specialist
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine
Groundwater Protection Permit No. G-0035-08

Dear Ms. Myers:

Enclosed please find the Fourth Quarter ~~1990~~ 1989 Analytical Results from the Hermit Mine Monitor Well. Also enclosed are the Hermit Mine shaft sample taken at an elevation of 908 feet below the shaft collar and the Hermit Mine sump sample. These samples are identified respectively as HER-052, 053 and 054. The date of collection for each was on December 8, 1989. Samples were obtained following procedures outlined in the Groundwater Protection Permit. Analysis was performed for the comprehensive list of parameters given in Part II.b.B.2.b. of the Groundwater Protection Permit. As reported in the closure report filed February 19, 1990, the Hermit Mine is currently undergoing closure procedures. Therefore, the shaft sample and the sump sample are the last monitoring information from these points to be available.

Contingency Requirements

Pursuant to provisions of Section 2.C, Contingency Requirements, in the Groundwater Protection Permit, Energy Fuels Nuclear hereby notifies the ADEQ of an exceedence of Alert Levels in the HER-052 monitor well sample. For elements Mn, Zn, U, Cl, K, Na, ^{230}Th, ^{226}Ra and pH.

This is Energy Fuels' address

One Tabor Center 1200 17th Street Suite 2500 Denver, Colorado 80202
303/595-0933

Proposed actions to be taken to investigate the causes for these apparent exceedences are outlined in the Hermit Mine Groundwater Monitoring Report Mining Phase submitted to ADEQ on February 13, 1990. Monthly monitoring of the well is now underway as outlined in this submittal.

If you have any questions concerning this matter, please contact me in our Denver office.

Sincerely,

Worked for Energy Fuels

William J. Almas
Environmental Coordinator

WJA:vrc
Enclosure

cc: Richard Munson
Robert Smith

HERMIT MINE MINING PHASE GRW QUALITY 6-MAR-90 09:09:53 Pg 1 ?

	A	B	C	D	E	F	G	H
1	PARAMETERS,	PREMINING	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	MAXIMUM
2	UNITS	SAMPLE	STANDARD	HER 044	HER 048	HER 051	HER 052	ACCEPTABLE
3		MEAN	DEVIATION	06-29-89	09-21-89	10-19-89	12-07-89	VALUE
4								
5	As,mg/l	0.012	0.0060	0.004	0.008	0.022	0.0080	0.0241
6	Ba,mg/l	0.022	0.0179	0.02	0.02	0.01	0.0200	0.0578
7	Cd,mg/l	0.005	0.0112	0.006	0	0	<0.005	0.0274
8	Cu,mg/l	0.022	0.0110	0.02	0	0	0.0200	0.0439
9	Fe,mg/l	6.98	2.1157	12	11.6	4.71	1.1300	11.2114
10	Pb,mg/l	0.03	0.0671	<0.02	<0.02	<0.02	<0.02	0.1642
11	Mn,mg/l	0.106	0.0404	0.23	0.49	0.39	0.2500	0.1867
12	Hg,mg/l	0.00054	0.0005	0	0	0	0.0002	0.0016
13	Se,mg/l	0.0152	0.0138	0.02	0.009	0.023	0.0060	0.0428
14	Ag,mg/l	0.01	0.0100	0	0	0		0.0300
15	Zn,mg/l	0.0678	0.0603	0.077	0	0.013	0.2580	0.1885
16	U, Total mg/l	0.0025	0.0003	0.0035	0.0043	0.0064	0.024	0.0030
17	Alk as CaCO3,mg/l	157.4	1.6733		150	0	155.0000	160.7466
18	HCO3 as CaCO3,mg/l	157.4	1.6733		150	150	155	160.7466
19	CO3,mg/l	0	0.0000			0		0.0000
20	Ca,mg//l	547	36.5718		542	547	466.0000	620.1437
21	Cl,mg/l	41.2	1.4370		40	39	52.0000	44.0740
22	Cr,mg/l	0.08	0.0663		<0.01	0.01	<0.01	0.2127
23	F,mg/l	1.37	0.0815		1.28	1.43	1.3000	1.5331
24	Mg,mg/l	181.6	8.9331		186	201	155.0000	199.4662
25	PO4,mg/l	0	0.0000		<0.1	<0.1	<0.1	0.0000
26	K,mg/l	23.28	2.6957		24.2	31.6	44.5000	28.6715
27	SiO2,mg/l	12.42	0.9602		11.5	9.8	8.9000	14.3404
28	Na,mg/l	74.8	5.4649		76	102	138.0000	85.7298
29	SO4,mg/l	2226	99.3982		2280	2280	2280.0000	2424.7964
30	TDS,mg/l	3456	29.6648		3440	3220	3310.0000	3515.3296
31	NO3 as N,mg/l	0.14	0.3130		0	0	<0.1	0.7661
32	Gross alpha,pCi/l	20.4	31.7616	28	19	78	22.0000	83.9232
33	Gross beta,pCi/l	33	5.2440	40	41	54	68.0000	43.4881
34	Th230,pCi/l	0.34	0.3286		0.2	0	3.1000	0.9973
35	Ra226,pCi/l	1.96	1.2054		3.3	0.8	2.4000	4.3708
36	Electrical conductivity,	3324	115.4556		3470	3600	3470.0000	3554.9112
37	umhos/cm	0	0.0000					0.0000
38	pH,units	7.5525	0.3500		6.92		7.2900	6.8525
39	TSS,mg/l	32.25	37.3486					0.0000
40	U,Dissolved mg/l							

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
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1455 DEMING WAY, SUITE 15
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PHONE: (702) 359-1150

6-Mar-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 2
Set : 1

Authority: Larry Casebolt
Project :

Purchase order :

Job: 891682E

Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	As Total mg/l	Ba Total mg/l	CO3 as CaCO3 mg/l	Cd Total mg/l
HER-052	155	0.008	0.02	<0.5	<0.005
HER-053	190	0.007	0.02	<0.5	<0.005
HER-054	218	0.205	0.02	<0.5	<0.005

Sample	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l
HER-052	466	52	<0.01	3470	0.02
HER-053	493	37	<0.01	3350	0.01
HER-054	537	30	<0.01	3410	0.03

When 53 & 54 sampled?

Sample	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HER-052	1.3	1.13	<0.02	155	0.25	0.0002
HER-053	1.0	1.05	<0.02	148	0.03	<0.0002
HER-054	1.3	0.19	0.03	170	0.06	0.0005

Sample	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Total mg/l	Se Total mg/l
HER-052	<0.1	7.29	<0.1	44.5	0.006
HER-053	<0.1	7.22	<0.1	34.3	0.009
HER-054	51.3	7.35	0.2	31.8	0.010



Earlier date than previous page and maybe not faxed from lab

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.RRINGER LABORATORIES INC.

30-Jan-90

Casebolt
GY FUELS NUCLEAR
. Box 36
edonia, AZ 86022

Page: 2
Copy: 2 of 2
Set : 1

Authority: Larry Casebolt
Project :

Purchase order :

Job: 891682E Status: Final

Sample Type: Water

Sample	SiO2 mg/l	Na Dissolved mg/l	TDS mg/l	SO4 mg/l	Zn Dissolved mg/l
HER-052	8.9	138	3310	2280	.258
HER-053	8.7	139	3220	2210	.026
HER-054	10.1	82	3450	2250	.093

Sample	Gross Alpha Total pCi/l	Error 2σ*	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*
HER-052	22	±18	68	±12	2.4	±0.5
HER-053	5600	±200	1920	±40	280	±10
HER-054	104000	±1000	44900	±200	7800	±100

Sample	Th-230 Total pCi/l	Error 2σ*	U Total mg/l	U Dissolved mg/l
HER-052	3.1	±1.0	0.024	0.0030
HER-053	1.4	±0.7	0.032	0.025
HER-054	5900.0	±100.0	36.6	11.9

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30-Jan-90

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Page: 3
Copy: 2 of 2
Set : 1

Authority: Larry Casebolt
Project :

Purchase order :

Status: Final

Job: 891682E

Abbreviations:

Analyses:

As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Na	: Sodium
TDS	: Total Dissolved Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

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30-Jan-90

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edonia, AZ 86022

Page: 4
Copy: 2 of 2
Set : 1

Authority: Larry Casebolt
Project :

Purchase order :

Job: 891682E

Status: Final

Units:

mg/l	:	milligrams per liter
µmho/cm	:	micromhos per centimeter at 25C
pCi/l	:	picoCuries per liter
2σ*	:	* Counting error at the 95% confidence level, 2σ

Quality control:

<	:	less than

Signed:

.....

Gary Zito
Laboratory Supervisor

TO Debra Daniel

FROM Abigail Myers

SUBJECT Hermit Mine CUPR

DATE 2/22/90

MESSAGE

Please review and comment on enclosed closure plan. gw (Can keep copy) Please inform me who is assigned thx

quality rpts

SIGNED Abby

REPLY

SIGNED

DATE / /

REDIFORM 4S 472

SEND PARTS 1 AND 3 INTACT -
PART 3 WILL BE RETURNED WITH REPLY.

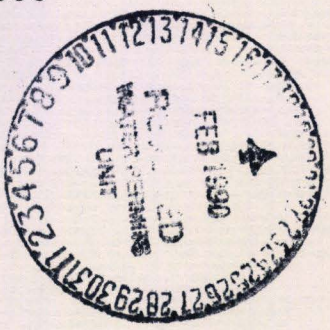
POLY PAK (50 SETS) 4P472

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561
fax 303-595-0930

February 19, 1990



Mr. Gary Ullinskey
Ms. Abigail Myers
Water Permits Unit
Arizona Department
of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

RE: Hermit Mine; Groundwater Protection Permit #G-0035-08

Dear Gary and Abby:

This letter follows the submission last week by Energy Fuels Nuclear, Inc. ("Energy Fuels") of two reports regarding groundwater monitoring at the Hermit Mine. In recent discussions with the hydrology unit, we advised the Department that mining operations have ceased at the Hermit Mine and that we are in the process of implementing the preliminary steps to final closure of the facility. I am providing each of you with a copy of this letter and the enclosure, a report from an engineering consulting firm, Behre Dolbear & Company, Inc. ("Behre Dolbear"), describing our closure plan in light of the requirements of the Groundwater Protection Permit for the Hermit Mine.

Given the very short life of the Hermit facility, it may be of some assistance to the Department to attempt to place our operations at Hermit in some relative perspective.

As you know, the Hermit Mine is located in an area of mining activity located north of the Grand Canyon. The Hermit is approximately six miles west of the Kanab North Mine and approximately twelve and one-half miles southwest of the Pigeon Mine.

The area in which the Hermit Mine is located was first recognized as a potential prospect by Energy Fuels personnel in 1981. Mining claims were staked in the area and exploration work began in 1982. Initial drilling operations began in 1983 and continued until mid-1986 with the delineation of a minable breccia pipe ore body. Some 33 deep bore holes and some 9 stratigraphic bore holes were drilled during the exploration program.

At the completion of the surface exploration program, minable reserves in excess of 2,000,000 pounds of uranium concentrates were anticipated to occur within the property boundaries. Consequently, the life of the mine was estimated to be between 5 and 8 years.

A Plan of Operations, dated February, 1987, was approved by the United States Bureau of Land Management during 1987 and a groundwater protection permit was issued for the facility on January 8, 1988. Construction of the mine began with the establishment of surface facilities. The underground development of the facility was completed in 1989.

Mining commenced in 1989 and by year-end we had mined approximately 32,000 tons of uranium ore containing approximately 464,000 pounds of uranium concentrates. Unfortunately, contrary to the indications from the surface exploration program, once underground we discovered that the uranium bearing ores were concentrated in rings near the exterior boundaries of the breccia pipe rather than in the breccia pipe itself. Through continuous underground exploration in 1989, we demonstrated the extent of minable reserves to be just slightly in excess of 500,000 pounds of uranium concentrates. Commencing in June of 1989 and ending in January of 1990, the minable reserve was mined. Ore recoveries through the life of the mine totalled approximately 500,000 pounds of uranium concentrates, or approximately 25% of anticipated mine life.

At this time, we have ceased operations and have initiated the removal of underground machinery, etc. in anticipation of closure of the mine. Work on the initial steps of the closure plan described in the Behre Dolbear report has begun with a view toward accomplishing the plan in a fairly short time frame.

As part of the closure process for the Hermit facility, Energy Fuels personnel and consultants have continued their analyses of the groundwater regime surrounding the Hermit facility. Under our original assumptions of a mine life of between 5 and 8 years, we expected to essentially de-water the perched zone as well as the breccia pipe itself. Given our mining period of less than one year, we are, at this time, still experiencing a mine inflow from the perched zone of the Coconino Horizon of some 15 to 20 gpm. One of our preliminary steps in formulating our closure plan was to identify the most feasible manner of isolating the perched zone from communication with other formations, principally the regional aquifer in the area, the Redwall-Muav Aquifer.

Given the continuous inflow from the perched zone in the Coconino Horizon, we want to accomplish partial closure of the mine as quickly as possible. We have several reasons to expedite the closure process. First, immediate closure of the mine will permit us to reestablish the integrity of the perched zone, thereby allowing the groundwater to remain in its original horizon. Second, the cost of keeping the mine on stand-by status is approximately $30,000 per month. Given the highly disappointing nature of the Hermit reserve, such a continuous outlay is significant. Third, we could use much of the physical plant from the Hermit facility at our planned Arizona One Project, which will be progressing in the very near future.

As described in the Behre Dolbear report, to accomplish the isolation of the perched zone, we need to backfill the shaft with native waste rock obtained during shaft sinking to the level indicated in the attached schematic. Obviously, once we have isolated that perched zone, further access to the mine workings is essentially eliminated.

K/C aquifer is continuous, it just deepens to the Supai group - See Kanab North well log 55-509198

As noted in our prior reports submitted to the Department regarding water quality, Energy Fuels believes that the Hermit Mine operation has not had, nor will it have, any effect on the Redwall-Muav Aquifer, the only significant and continuous source of groundwater in the area. Based on our review of existing data and our knowledge of activities in the general area of the mine, we do not believe there are any other users of the Redwall-Muav Aquifer in the general geographic area of the mine. There is, obviously, communication between the Redwall-Muav and the Colorado River through discharge points located in the north rim of the Grand Canyon. The results from the samples obtained to date certainly do not indicate any effect on the Redwall-Muav aquifer from our mining operation.

As noted in the reports, we intend to continue to monitor the water well after closure of the mine to ascertain a more representative number of samples to allow us and the Department to better analyze the water quality.

As noted, the enclosed general plan for closure presents our intentions and plans for isolating the current water source in the Coconino formation and as also noted, we are desirous of expediting our closure activities at the Hermit facility. Once you have had an opportunity to review the information contained

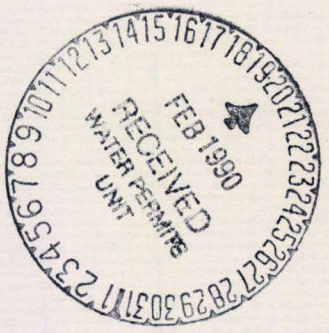
in the closure plan, we would welcome an opportunity to discuss with you and other Department staff, if advisable, the Hermit facility and our closure operations.

Sincerely,

Rich A. Munson

Rich A. Munson
Corporate Counsel

/ram
Enclosure: Report by Behre Dolbear
& Company, dated February, 1990



energy fuels nuclear, inc.

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1200 seventeenth street • denver, colorado 80202

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twx 910-931-2561
fax 303-595-0930

February 13, 1990

Ms. Abigail A. Myers
Environmental Program Specialist
Water Permits Unit
Arizona Department of Environmental Quality
2005 N. Central
Phoenix, Arizona 85004

RE: Hermit Mine

Dear Abby:

Enclosed herewith, please find copies of the following:

1. Hermit Mine
Groundwater Monitoring Report Mining Phase and,

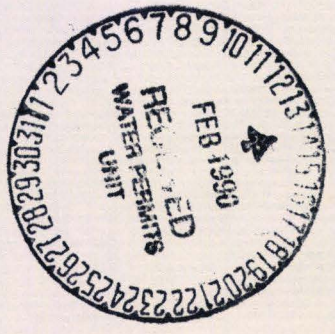
2. Hermit Mine
Permining Water Quality Report

If you should have any questions, please feel free to contact the undersigned.

Sincerely,

Rich A. Munson
Corporate Counsel

RAM/kmd
Enclosures (2)
FEDERAL EXPRESS #3968460414



HERMIT MINE
GROUNDWATER MONITORING REPORT
MINING PHASE

SUBMITTED TO
ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

BY
ENERGY FUELS NUCLEAR, INC.

FEBRUARY 12, 1990



Hermit Mine
Groundwater Monitoring Report
Mining Phase

Introduction

The Hermit Mine operates under the terms and conditions of the Hermit Mine Groundwater Protection Permit #G-0035-08. Section II.B.1.b. of the Permit outlines groundwater monitoring actions which must be taken during the mining phase of operations. This report presents and summarizes data collected during the mining phase.

Table I lists the dates, types and purposes of samples included within this report.

Discharge Monitoring

The Hermit Mine Facility was designed as a non-discharging facility. The surface facilities associated with the mine have been designed so that all surface water drains to lined surface impoundments. Mine water produced during mining operations has been pumped to the lined surface impoundments for evaporation or for use within the mine operations area for dust suppression.

A septic system with an associated leach field has been constructed at the Hermit Mine for disposal of sewage and wash water only. In compliance with provisions of the Groundwater Protection Permit, septic system effluent is sampled on an annual basis and analyzed for the parameters listed in II.B.2.b.

An annual septic system sample was obtained by bailing from the septic tank through the clean-out port. Analytical results are presented as Attachment I to this report.

Impoundment Monitoring

Only one pond was originally lined

The lined evaporation ponds are inspected visually on a daily basis by mine personnel. Once a month a formal inspection is performed by the Mine Superintendent and documented on a Safety and Environment Inspection Form. No mechanical damage to the liner has been detected. Adequate freeboard has been maintained throughout the mining operation.

TABLE I

Summary of Mining Phase Groundwater Samples

Sample Rate	Sample Number	Sample Purposes	Sampling Parameters	Monitor Period
06-27-89	HER 043	Mine Sump	II.B.2.b	2nd Quarter
06-29-89	HER 044	Monitor Well	II.B.2.a	2nd Quarter
06-27-89	HER 045	Shaft Sample	II.A.2.b	2nd Quarter
09-21-89	HER 048	Monitor Well	II.A.2.b	3rd Quarter
09-21-89	HER 049	Sump Sample	II.A.2.b	3rd Quarter
09-21-89	HER 050	Shaft Sample	II.A.2.b	3rd Quarter
10-19-89	HER 051	Confirmation Sample	II.A.2.b	2nd Quarter
10-02-89	HER 1S-45	Septic Sample	II.A.2.b	Annual

Would be an example of R/M water

Where was the confirmation sample collected from, and why was a 2nd Quarter sample collected on October 19th?

Groundwater Monitoring

Groundwater monitoring of the water supply/monitoring well, Department of Water Resources Well Registry #55-518877 has taken place on a quarterly basis during the mining phase. Samples HER 044 and HER 048 represent Second and Third Quarter, 1989 sampling data. Results are included in Attachment II.

Sample HER 044 was sampled for the list of parameters listed in II.B.2.a (Indicator Parameters), as per requirements of the Groundwater Protection Permit. It was determined after review of HER 044 that sample analysis indicated concentrations of iron (Fe), manganese (Mn) and uranium (U) in excess of maximum groundwater limits as established in the premining period (Refer to Hermit Mine Premining Water Quality Report). A confirmation sample for the comprehensive list of parameters contained in Part II.B.2.b was then taken on October 19, 1989 and is identified as HER 051. HER 051 results are contained within Attachment II.

Water Quality Results

Table II, Mining Water Quality Results, presents a comparison of monitor well water quality analysis results (HER 044, 048 and 051) to maximum groundwater limits as determined following procedures in the Groundwater Protection Permit.

Concentrations of Mn and U have consistently exceeded maximum groundwater limits for the three samples for which sample results are available. Additionally, magnesium, potassium, sodium, gross beta and electrical conductivity exceeded maximum groundwater limits in the HER 051 sample.

Several possible explanations for the exceedances exist. The most likely explanation is that increased sediment from the well field has resulted in increased levels of radionuclides and other constituents within well water. According to field personnel responsible for sample collection, a noticeable change in the amount of suspended solids occurred during January and February, 1989.

Which may be Fe+3 precipitating out of solution?

HERMIT MINE GRDW RESULTS-MINING 21-DEC-89 14:45:17 Pg 1

Pre-mining samples were collected from boreholes, one from within the breccia pipe and one outside of the pipe

	A	B	C	D	E	F	G
1	PARAMETERS,	PREMINING	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	MAXIMUM
2	UNITS	SAMPLE	STANDARD	HER 044	HER 048	HER 051	ACCEPTABLE
3		MEAN	DEVIATION	06-29-89	09-21-89	10-19-89	VALUE
4							
5	As,mg/l	0.012	0.0060	0.004	0.008	0.022	0.0241
6	Ba,mg/l	0.022	0.0179	0.02	0.02	0.01	0.0578
7	Cd,mg/l	0.005	0.0112	0.006	0	0	0.0274
8	Cu,mg/l	0.022	0.0110	0.02	0	0	0.0439
9	Fe,mg/l	6.98	2.1157	12	11.6	4.71	11.2114
10	Pb,mg/l	0.03	0.0671	0	0	0	0.1642
11	Mn,mg/l	0.106	0.0404	0.23	0.49	0.39	0.1867
12	Hg,mg/l	0.00054	0.0005	0	0	0	0.0016
13	Se,mg/l	0.0152	0.0138	0.02	0.009	0.023	0.0428
14	Ag,mg/l	0.01	0.0100	0	0	0	0.0300
15	Zn,mg/l	0.0678	0.0603	0.077	0	0.013	0.1885
16	U,mg/l	0.0025	0.0003	0.0035	0.0043	0.0064	0.0030
17	Alk as CaCO3,mg/l	157.4	1.6733		150	0	160.7466
18	HCO3 as CaCO3,mg/l	157.4	1.6733		150	150	160.7466
19	CO3,mg/l	0	0.0000			0	0.0000
20	Ca,mg//l	547	36.5718		542	547	620.1437
21	Cl,mg/l	41.2	1.4370		40	39	44.0740
22	Cr,mg/l	0.08	0.0663		0	0.01	0.2127
23	F,mg/l	1.37	0.0815		1.28	1.43	1.5331
24	Mg,mg/l	181.6	8.9331		186	201	199.4662
25	PO4,mg/l	0	0.0000		0	0	0.0000
26	K,mg/l	23.28	2.6957		24.2	31.6	28.6715
27	SiO2,mg/l	12.42	0.9602		11.5	9.8	14.3404
28	Na,mg/l	74.8	5.4649		76	102	85.7298
29	SO4,mg/l	2226	99.3982		2280	2280	2424.7964
30	TDS,mg/l	3456	29.6648		3440	3220	3515.3296
31	NO3 as N,mg/l	0.14	0.3130		0	0	0.7661
32	Gross alpha,pCi/l	20.4	31.7616	28	19	78	83.9232
33	Gross beta,pCi/l	33	5.2440	40	41	54	43.4881
34	Th230,pCi/l	0.34	0.3286		0.2	0	0.9973
35	Ra226,pCi/l	1.96	1.2054		3.3	0.8	4.3708
36	Electrical conductivity,	3324	115.4556		3470	3600	3554.9112
37	umhos/cm	0	0.0000				0.0000
38	pH,units	7.5525	0.3500		6.92		6.8525
39	TSS,mg/l	32.25	37.3486				0.0000
40							

See septic tanks concentrations pages 341-342
U=39 ppb (11/30/1989 results)
Gross alpha = 195 pCi/L

TABLE II

Mining Water Quality Results

The color of well water changed from nearly clear to red in color. The red color is apparently due to increased silt and fine sand from the Redwall-Mauv formation. The increased suspended solids could indicate that continued pumping of the well for operational purposes is resulting in increased fine sediment from the production zone within the Redwall-Mauv aquifer. Possible sources of fine sediment and sand are silty sandstone layers within the Redwall-Mauv formation. The existence of these layers is well documented in Billingsley (1985). The introduction of additional suspended sediment may be a source of higher concentrations of some chemical constituents in monitoring samples. Additionally, since radionuclides are analyzed for total concentrations (dissolved and suspended constituents), increases in sediment contribute to greater concentrations.

Or Fe+3 precipitating out of solution

In order to test this theory, two Hermit Mine monitor well samples have been analyzed again for both dissolved and total uranium concentrations. Comparison of uranium analyzed for both dissolved and total uranium within the same sample shows dramatic reduction in uranium content when considering only dissolved uranium. The Fourth Quarter, 1989 groundwater monitoring well sample (HER 052; submitted under separate cover) indicates dissolved uranium at a concentration of 0.003 mg/l. Total uranium is shown as 0.024 mg/l. The concentration of 0.003 mg/l is within maximum groundwater limits. Also, reanalysis of sample HER 048 indicates a similar reduction in uranium concentrations from 0.0041 mg/l total uranium to 0.0011 mg/l dissolved uranium.

The method used for U detection in 1989 could not have measure a U concentration this low and original sample should have been filtered

Lab could not measure concentrations below 0.005 mg/L

Barringer Labs could not measure to this precision

Sampling and/or analytical procedures and variability are other sources of possible error. Groundwater monitoring samples are collected following procedures outlined in the Groundwater Protection Permit and recommended sampling protocols outlined in EPA publication EPA/600/2-85/104, "Practical Guide for Groundwater Sampling". Sampling procedures include appropriate field filtering with a 0.45 micron filter after voiding the well casing volume, preservation of samples with appropriate

stabilizing chemicals, cooling of samples to below 4°C and usual holding times between laboratory and sampling of between 12 and 48 hours. Also, Chain of Custody forms are completed and maintained as documentation. Sampling error has been minimized through adherence to these procedures.

This is untrue - some holding times were at least 2 weeks

The accuracy of analytical techniques and equipment is another possible source of error. Parameters indicating concentration increases in the 0.1, 0.01 or 0.001 of a mg/l must be viewed in the context of the accuracy and variability of equipment and laboratory techniques. Individual sample analysis can not be viewed as a reliable indicator of real trends in groundwater quality at negligible concentration levels. Only repeated sampling with adequate quality control can be relied upon to show real trends.

TABLE III
Mine Inflow During Mining

Month/1989	Total Volume (Gallons)
June	527,800
July	660,672
August	678,528
September	777,600
October	758,880
November	734,400
December	669,600

Other possible sources of apparent high concentrations of some constituents in groundwater are natural causes related to the season, variations in precipitation amounts or other unidentified temporally or spatially related factors. A total of only eight samples have been taken to date, spanning a time period of less than two years. This is an inadequate number of samples and too short a time frame to detect naturally occurring changes in groundwater quality.

Mine Inflow Monitoring

Table III illustrates mine inflow volumes as determined by a totaling flow meter measuring discharge from the mine sump to the surface evaporation pond. Water was produced almost entirely from the area just above the Coconino sandstone-Toroweap limestone contact. The location for the monitor point for water quality inflow is located 908 feet below the shaft collar elevation as shown on Plate 1 of the Premining Water Quality Report.

Water quality samples and analysis have been obtained from both the monitor point in the shaft and the mine sump. Samples HER 045 and 050 are shaft inflow monitoring samples and are included in Attachment III, Shaft Water Monitoring Samples Analysis. Samples have been analyzed for the parameters listed in II.B.2.b. Samples HER 043 and 049 are samples taken from water originating in the mine sump and analyzed for the parameters listed in II.B.2.b. Water quality analysis for these analysis are included in Attachment 4.

Contingency Requirements

Pursuant to provisions of Section II.C, Contingency Requirements, in the Groundwater Protection Permit, EFN hereby notifies the ADEQ of an exceedance of alert levels in the HER 044 monitor well sample (taken 06/29/89) for indicator elements iron, manganese and uranium. HER 051, taken 10-19-89, is the confirmation sample which indicated a continued exceedance of maximum groundwater

limitations for manganese and uranium, but not iron. Additionally, the confirmation sample showed exceedances in magnesium, potassium, sodium, gross beta and electrical conductivity.

Then why did U concentrations rise?

Why is there U in the septic water ?

There is no reason to believe that groundwater within the Redwall-Muav aquifer has been impacted by mining operations in anyway. Detailed evaluation of the site specific hydrogeology of the area was performed by Canonie Environmental and presented to the ADEQ in the report, "Potential Impacts of Mining on Groundwater Resources, October, 1987". Other researchers, such as Huntoon (1974) and (1982), Levings (1979) and Metzger (1961) have studied and described the hydrogeology of the Grand Canyon area as well. These investigations all note the very low transmissivities of the Hermit Shale to groundwater flow, except where major faults allow downward vertical flow. It is also well documented that the geologic profile is unsaturated to the Redwall-Mauv limestones, except for localized perch zones, such as the Coconino sandstone-Hermit shale interface at the Hermit Mine site. Based upon the best available evidence from numerous sources, the likelihood of groundwater communication between the mine workings and Redwall-Mauv aquifer is remote.

In the unlikely event that communication between the mine workings and the Redwall-Mauv aquifer were taking place, impacts to the Redwall-Mauv aquifer would be negligible. Although the most recent sample (HER 051) indicates seven parameters with concentrations in excess of maximum groundwater limits, these limits, in absolute terms, are very low. Maximum groundwater limits are based on the premining water quality average plus two standard deviations of the sampling mean. Thus, maximum groundwater limits are based on background concentrations, and are not health based standards.

Three of the seven parameters (Mn, SO_4 and TDS) have a federal secondary drinking water standard associated with them. In all cases, the premining mean (baseline) of sample results exceeds the secondary standard. Secondary drinking water standards apply principally to aesthetics of drinking water and are not health based, except at much high concentrations.

EPA MCL U = 30 ppb (2000 lowered from 1977)

Three parameters (U, Na, Mg) have no primary or secondary drinking water standard associated with them. Uranium concentrations are reflected in gross alpha radiation determinations. Since the premining baseline already exceeds the primary drinking water standard and gross alpha radiation determinations fall within maximum groundwater limitations, increased uranium concentrations are not considered an immediate concern.

Gross beta might exceed the 4 MREM/year primary drinking water standard, depending on the proportions of various radionuclides contributing to the gross beta measurement.

Proposed Actions and Summary

Energy Fuels Nuclear has investigated the site hydrogeology at the Hermit Mine and on the basis of all existing available information, believes that apparent exceedances of maximum groundwater limits are attributable to causes other than contamination as a result of mining activities. Possible causes for the apparent exceedances have been listed and briefly discussed in the Water Quality Results section of this report.

Energy Fuels Nuclear's proposed approach to determining the cause(s) of the apparent exceedances is to augment the existing monitoring program in an attempt to confirm or eliminate sources of error. The following actions are proposed:

- Accelerate sampling to a monthly basis for the monitoring well and perform analysis for the full series of parameters listed in II.B.2.b in order.

- Evaluate the feasibility of using radiochemical or colored tracers carbon dating of water or use of stable isotope analysis to determine the relative age and/or source of groundwater in the monitoring well. The feasibility of using these techniques will be discussed in the next quarterly monitoring report.

- Initiate additional quality control into the sampling and analytical processes by obtaining split samples and submitting samples to two different laboratories for comparison.

- Analyze groundwater samples for both total and dissolved radionuclides to determine the effects of increased suspended matter in groundwater samples.

- Analyze groundwater samples for all major radionuclides within the U-238 decay chain to determine specific sources of alpha contamination.

These steps are proposed for a three month period. After receiving this information, it will be compiled, evaluated and presented to ADEQ for review and discussion.

REFERENCES

Billingsley, George H., Stanley S. Beus. The Surprise Canyon formation-an Upper Mississippian and Lower Pennsylvanian rock unit in the Grand Canyon, Arizona. U.S. Geological Survey Bulletin 1605-A, 1985, p A27-A33. What is this in reference to?

Canonie Environmental Services Corp. Potential impacts of mining on groundwater resource and for the Hermit Mine. Report to Energy Fuels Nuclear, Inc., November 6, 1987.

Huntoon, P. W., 1974. The karstic groundwater basins of the Kaibab Plateau. Water Resources Research; Volume 10, No. 3, p. 579-590.

Huntoon, P. W. 1982. The groundwater systems that drain to the Grand Canyon of Arizona. University of Wyoming, Laramie. Unpublished. ?

Levings, G. W., C. D. Farrar, 1979. Maps showing groundwater conditions in the Kanab area, Coconino County and Mohave County, Arizona. U.S. Geologic Survey, Water Resources Investigations, Open File Report 79-1070.

Metzger, D. G., 1961. Geology in relation to availability of water along the south rim Grand Canyon National Park, Arizona. U.S. Geological Survey Water-Supply Paper 1475-C, p. 105-135. Hermit Mine is north of the Grand Canyon NP

ATTACHMENT 1

SEPTIC ANNUAL MONITORING RESULTS

Septic water would be originally from the R/M water well, the mine's office and showers were drawing off of the R/M well (ADWR 55-518877)

BARRINGER LABORATORIES INC.

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30-Nov-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 2
Set : 1

Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

Sample Type: Water

Sample Id	Alkalinity as CaCO3 mg/l	As Total mg/l	Ba Total mg/l	HCO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l
HER 1S-4S	479	0.007	0.02	479	<0.005	475	859

More alkaline than monitoring well

Ca ≈20% lower

Cl- >20x higher than monitoring

Sample Id	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HER 1S-4S	<0.01	5760	0.04	1.20	0.45	<0.02	147

Sample Id	Mn Total mg/l	Hg Total mg/l	NO3 as N mg/l	PO4 as P Total mg/l	K Total mg/l	Se Total mg/l	SiO2 mg/l
HER 1S-4S	0.29	<0.0002	<0.1	5.8	42.5	0.018	11.1

Sample Id	Ag Total mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HER 1S-4S	<0.01	841	4720	2100	0.572	195	±40

Na ≈10X

Sample Id	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HER 1S-4S	110	±20	29	±3	5.4	±1.4	0.039

U=39 ppb but would be higher if gross alpha is 195 pCi/L s/b≈ 290 ppb

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Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

Abbreviations:

Analyses:

As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

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Page: 3
Copy: 1 of 2
Set : 1

Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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30-Nov-89

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Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 10/2/89 By: T.Moncrief Via: UPS

Sample Container Type: large cube
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Swanson	10/18
As	1	206.2	0.001 mg/l	1	Gilleland	10/18
Ba	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Cd	1	200.7	0.005 mg/l	1	Hidalgo	10/25
Ca	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Cl	1	325.2	1 mg/l	3	Hobbs	10/13
Cr	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/13
Cu	1	200.7	0.01 mg/l	1	Hidalgo	10/25
F	1	340.2	0.05 mg/l	3	Acree	10/23
Fe	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Pb	1	200.7	0.02 mg/l	1	Hidalgo	10/25
Mg	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Mn	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Hg	1	245.1	0.0002 mg/l	1	Swanson	10/13
NO3	1	353.1	0.1 mg/l	2	Hobbs	10/9
PO4	1	365.1	0.1 mg/l	3	Hobbs	10/11
K	1	200.7	0.5 mg/l	1	Hidalgo	10/25
Se	1	270.2	0.001 mg/l	1	Gilleland	10/19
SiO2	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Ag	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Na	1	200.7	0.01 mg/l	1	Hidalgo	10/25

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30-Nov-89

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Authority:
Project :

Purchase order :

Job: 891246E Status: Final

TDS	1	160.1	10	mg/l	3	Acree	10/16
SO4	1	375.3	5	mg/l	3	Acree	10/16
Zn	1	200.7	0.005	mg/l	1	Hidalgo	10/25
Gr.Alpha	4	---	1.0	pCi/l	3	Seidel	11/2-11/17
Gr.Beta	4	---	2.0	pCi/l	3	Seidel	11/2-11/17
Ra-226	4,7,14	---	0.2	pCi/l	3	Howard	10/31-11/2
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/7-11/10
U	4,9,10,14	---	0.3	µg/l ?	3	Krizman	10/18-11/20

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30-Nov-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER 1S-4S	Alkalinity	479.0	482.6	0.6
HER 1S-4S	As	.007	.007	0.0
HER 1S-4S	Ba	.02	.02	0.0
HER 1S-4S	Cd	<.005	<.005	0.0
HER 1S-4S	Ca	475	476	0.2
HER 1S-4S	Cl	852	865	1.5
HER 1S-4S	Cr	<.01	<.01	0.0
HER 1S-4S	Sp.Cond.	5761.1	5761.1	0.0
HER 1S-4S	Cu	.04	.04	0.0
HER 1S-4S	Fe	.45	.45	0.0
HER 1S-4S	Pb	<.02	<.02	0.0
HER 1S-4S	Mg	147	147	0.0
HER 1S-4S	Mn	.29	.29	0.0
HER 1S-4S	Hg	<.0002	<.0002	0.0
HER 1S-4S	NO3	<.1	<.1	0.0
HER 1S-4S	PO4	5.77	5.77	0.0
HER 1S-4S	K	42.5	42.2	0.7
HER 1S-4S	Se	.018	.016	12
HER 1S-4S	SiO2	11.1	11.1	0.0
HER 1S-4S	Ag	<.01	<.01	0.0
HER 1S-4S	Na	841	842	0.1
HER 1S-4S	Zn	.572	.579	1.2
HER 1S-4S	Gr.Alpha	150 ± 30	87 ± 16	23.1
HER 1S-4S	Gr.Beta	240 ± 50	130 ± 20	19.8
HER 1S-4S	U	.041	.036	6.5

How is Gross Beta higher than Gross Alpha?

41 ppb

36 ppb

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30-Nov-89

Larry Casebolt
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P.O. Box 36
Fredonia, AZ 86022

Page: 7
Copy: 1 of 2

What does this have to do with the septic water monitoring?

Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
As	.097	.100	.080 - .118	3	---
Ba	.97	.97	.89 - 1.09	0.0	96
Cd	.209	.200	.180 - .220	4.5	104
Ca	254	250	225 - 275	1.6	104
Cl	25.3	26.05	24.1 - 27.7	2.9	---
Cr	.206	.200	.180 - .220	3.0	100
Cu	.200	.200	.180 - .220	0.0	99
F	.52	.50	.45 - .55	3.9	103
Fe	.216	.200	.180 - .220	8.0	120
Pb	.206	.200	.180 .220	3.0	93
Mg	242	250	225 - 275	3.2	108
Mn	.208	.200	.180 - .220	4.0	104
Hg	.008	.008	.007 - .009	0.0	100
NO3	2.06	1.98	1.78 - 2.18	4.0	---
PO4	.47	.50	.46 - .54	6.2	---
K	10.0	10.0	9.0 - 11.0	0.0	85
Se	.009	.009	.006 - .012	0.0	---
SiO2	.94	1.00	.90 - .110	6.0	---
Ag	1.04	.99	.89 - 1.09	5.0	101
Na	249	250	225 - 275	0.4	101
TDS	1408	1479	1331 - 1627	4.9	---
SO4	1062	1000	900 - 1100	6.0	---
Zn	.207	.200	.180 - .220	3.5	118
Gr.Alpha	193 ± 4	198	178 - 218	2.5	---
Gr.Beta	164 ± 2	179	161 - 197	8.4	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	102 ± 3	99	94 - 104	3.0	---
U	35	34	32 - 36	2.9	---

Approved by: _____

ATTACHMENT 2

SECOND AND THIRD QUARTER, 1989
WELL MONITORING RESULTS
AND
SECOND QUARTER, 1989 CONFIRMATION SAMPLE RESULTS

What “monitoring” well?

Not faxed from lab

BARRINGER LABORATORIES INC.

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1466 DEMING WAY, SUITE 15
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PHONE: (702) 358-1188

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: L. Casebolt

Client No. Log No. 633 Client PO No.

Sample Type: water

Date Collected: 6/29/89 Date Received: 7/7/89 Date Reported: 8/3/89

RESULTS OF ANALYSIS

Sample Identification	As Total mg/l	Ba Total mg/l	Cd Total mg/l	Cu Total mg/l	Fe Total mg/l	Pb Total mg/l	Mn Total mg/l
HER044	.004	.02	.006	.02	12.0	<.02	.23

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	Se Total mg/l	Ag Total mg/l	Zn Total mg/l
HER044	<.0002	.3	.020	<.01	.077

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER044	28 ± 21	40 ± 11	0.0035

3.5 ppm

"Monitoring Well" ≈10x lower U than septic tank water

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

This is from a separate document then the following 2 pages

Approved by

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 633

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 7/7/89 By: Gina Reichert Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Arsenic	1	206.2	1 ug/l	1	G. Gilliland	7/19/89
Selenium	1	270.2	1 ug/l	1	G. Gilleland	7/19/89
Nitrate	1	353.1	0.1 mg/l	2	D. Hobbs	7/20/89
Mercury	1	245.1	0.2 ug/l	1	M. Swanson	7/20/89
Barium	1	200.7	10 ug/l	1	D. Hidalgo	7/20/89
Cadmium	1	200.7	5 ug/l	1	D. Hidalgo	7/20/89
Copper	1	200.7	10 ug/l	1	D. Hidlago	7/20/89
Iron	1	200.7	10 ug/l	1	D. Hidalgo	7/20/89
Lead	1	200.7	2 ug/l	1	D. Hidalgo	7/20/89
Manganese	1	200.7	1 ug/l	1	D. Hidalgo	7/20/89
Silver	1	200.7	10 ug/l	1	D. Hidalgo	7/20/89
Zinc	1	200.7	5 ug/l	1	D. Hidalgo	7/20/89
Alpha-Beta	4		1.0,2.0 pCi/l	3	M. Kidwell	7/19-7/31/89
Uranium	4,14		0.3 ug/l	3	B. Tonning	7/26-7/29/89

LLD for U is 5 not 0.3

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER044	Arsenic	.004	.005	20.0%
HER044	Selenium	.019	.019	0.0%
HER044	Nitrate	.3	.3	0.0%
HER044	Mercury	<.0002	<.0002	0.0%
HER044	Barium	.02	.02	0.0%

Approved by _____

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Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 633

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER044	Cadmium	.006	<.005	---
HER044	Copper	.02	.02	0.0%
HER044	Iron	12.0	11.9	0.8%
HER044	Lead	<.02	<.02	0.0%
HER044	Manganese	.23	.23	0.0%
HER044	Silver	<.01	<.01	0.0%
HER044	Zinc	.077	.074	3.9%
HER044	Gross Alpha	13 ± 19	42 ± 23	54.0%
HER044	Gross Beta	39 ± 11	42 ± 11	3.7%

QUALITY CONTROL STANDARDS

How are the concentrations previously known?

No sample ID

Parameter	Result	Certified Result	Target Range	Relative Deviation From Known	Spike % Recovery
Arsenic	.062	.062	.048 - .073	0.0%	100
Selenium	.009	.009	.006 - .012	0.0%	---
Nitrate	2.08	1.98	1.78 - 2.18	4.9%	101
Mercury	.005	.005	.004 - .006	0.0%	100
Barium	.96	.97	.87 - 1.07	1.0%	97
Cadmium	.212	.200	.180 - .220	6.0%	98
Copper	.205	.200	.180 - .220	2.5%	104
Iron	.219	.200	.180 - .220	9.5%	---
Lead	.181	.200	.180 - .220	9.5%	97
Manganese	.207	.200	.180 - .220	3.5%	106
Silver	.90	.99	.89 - 1.09	9.0%	90
Zinc	.203	.200	.180 - .220	1.5%	115
Gross Alpha	216 ± 4	198	178 - 218	9.1%	---
Gross Beta	175 ± 2	179	161 - 197	2.2%	---
Uranium	33	34	32 - 36	2.9%	---

Approved by Barbara Cope

BARRINGER LABORATORIES INC.

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18-Dec-89

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	NH4 as N mg/l	As Total mg/l	Ba Total mg/l	HCO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l
HERO 48	150	0.3	0.008	0.02	150	<0.005	542
HERO 49	116	14.5	0.530	0.01	116	<0.005	521
HERO 50	203	0.3	0.006	0.01	203	<0.005	510

Sample	Cl Total mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HERO 48	40	<0.01	3470	<0.01	1.28	11.60	<0.02	186
HERO 49	38	<0.01	3820	0.02	1.35	0.25	0.03	187
HERO 50	38	<0.01	3590	<0.01	0.98	1.11	<0.02	162

Sample	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Total mg/l	Se Total mg/l
HERO 48	0.49	<0.0002	0.02	<0.1	6.92	<0.1	24.2	0.009
HERO 49	0.08	<0.0002	6.45	31.4	6.69	<0.1	36.1	0.017
HERO 50	0.02	<0.0002	0.01	<0.1	7.05	<0.1	36.4	0.011

No "Approved by"

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18-Dec-89

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Denver, CO 80202

Page: 2
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Job: 891214E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	SiO2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HERO 48	11.5	<0.01	76.0	3440	2280	<0.005	19	±18
HERO 49	11.2	0.02	97.8	3530	2300	0.156	29800	±300
HERO 50	9.9	<0.01	144.0	3320	2190	0.009	1400	±100

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HERO 48	41	±10	3.3	±0.6	0.2	±0.5	0.0041
sump HERO 49	10100	±100	60	±3	710	±20	18.4
HERO 50	150	±10	350	±10	1.7	±0.9	0.025

milligrams per liter/
parts per million

18,400 ppb

It is not possible to have 29,800 pCi/L gross alpha and only 18,400 ppb concentration of U

Alpha decay in pCi/L should be approximately 2/3 the value of U concentration in micrograms/L or parts per billion

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Abbreviations:

Analyses:

NH4 as N	:	Ammonia
As	:	Arsenic
Ba	:	Barium
HCO3	:	Bicarbonate
Cd	:	Cadmium
Ca	:	Calcium
Cl	:	Chloride
Cr	:	Chromium
Cu	:	Copper
F	:	Fluoride
Fe	:	Iron
Pb	:	Lead
Mg	:	Magnesium
Mn	:	Manganese
Hg	:	Mercury
Mo	:	Molybdenum
NO3 as N	:	Nitrate
PO4 as P	:	Phosphate
K	:	Potassium
Se	:	Selenium
SiO2	:	Silica
Ag	:	Silver
Na	:	Sodium
TDS	:	Total Dissolved Solids

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SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

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AMENDED REPORT

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 9/27/89 By: T.Moncreif Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH/Zn Acetate
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Swanson	10/5
NH4	1	350.1	0.1 mg/l	2	Hobbs	10/5
As	1	206.2	0.001 mg/l	1	Gilleland	10/4
Ba	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cd	1	200.7	0.005 mg/l	1	Hidalgo	10/20
Ca	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cl	1	325.2	1 mg/l	3	Hobbs	10/4
Cr	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/5
Cu	1	200.7	0.01 mg/l	1	Hidalgo	10/20
F	1	340.2	0.05 mg/l	3	Acree	10/12
Fe	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Pb	1	200.7	0.02 mg/l	1	Hidalgo	10/20
Mg	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Mn	1	200.7	0.01 mg/l	1	Hidalgo	10/20

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Hg	1	245.1	0.0002	mg/l	1	Swanson	10/2
Mo	1	200.7	0.01	mg/l	1	Hidalgo	10/20
NO3	1	353.1	0.1	mg/l	2	Hobbs	10/3
pH	1	210.1	0.01	unit	3	Acree	10/2
PO4	1	365.1	0.1	mg/l	3	Hobbs	10/11
K	1	200.7	0.5	mg/l	1	Hidalgo	10/20
Se	1	270.2	0.001	mg/l	1	Gilleland	10/4
SiO2	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Ag	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Na	1	200.7	0.01	mg/l	1	Hidalgo	10/20
TDS	1	160.1	10	mg/l	3	Acree	10/3
SO4	1	375.3	5	mg/l	3	Acree	10/3
Zn	1	200.7	0.005	mg/l	1	Hidalgo	10/20
Gr.Alpha	4	900.0	1.0	pCi/l	3	Seidel	11/16-12/1
Gr.Beta	4	900.0	2.0	pCi/l	3	Seidel	11/16-12/1
Ra-226	4,7,14	903.0,903.1	0.2	pCi/l	3	Howard	10/31-11/2
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/6-11/10
U	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Tonning	10/17-11/20
U(RR)	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Krizman,Tonning	12/11-12/18

This method's lower limit was only 5 micrograms/liter not 0.3

Why is U testing 2 months later?

ASTM D2907-97 [WITHDRAWN]
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
STANDARD by ASTM International, 08/10/1997
1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L

.1.2 The uranium fluorescence is quenched by many cations and some anions in the sample; it is enhanced by a few cations. If interfering ions are present, a direct fluorometric measurement is not suitable, and an extraction method must be used to provide accurate results. The test methods and their concentration ranges are as follows:

Concentration Range, mg/L Sections Test Method A---Direct Fluorometric 0.005 to 2 7 to 15 Test Method B---Extraction 0.04 to 50 16 to 24
1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific hazards, see Note 1.
https://www.astm.org/d2907-97.html

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Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HERO 50	Alkalinity	203	203	0.0
HERO 50	NH4	.34	.34	0.0
HERO 50	As	.006	.006	0.0
HERO 50	Ba	.01	.01	0.0
HERO 50	Cd	<.005	<.005	0.0
HERO 50	Ca	510	511	0.2
HERO 50	Cl	38.2	38.2	0.0
HERO 50	Cr	.01	<.01	---
HERO 50	Sp.Cond.	3590	3590	0.0
HERO 50	Cu	<.01	<.01	0.0
HERO 50	Fe	1.11	1.11	0.0
HERO 50	Pb	<.02	<.02	0.0
HERO 50	Mg	162	161	0.6
HERO 50	Hg	<.0002	<.0002	0.0
HERO 50	Mo	.01	<.01	---
HERO 50	NO3	<.1	<.1	0.0
HERO 50	PO4	<.1	<.1	0.0
HERO 50	K	36.4	36.0	1.0
HERO 50	Se	.010	.011	9
HERO 50	SiO2	9.9	9.9	0.0
HERO 50	Ag	<.01	<.01	0.0
HERO 50	Na	144	143	0.7
HERO 50	Zn	.009	.008	---
HERO 50	U	.025	.025	0.0
HERO 48	U(RR)	.0044	.0039	6.0

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Again - this is just recycled data from the Lab Accuracy testing

QUALITY CONTROL STANDARDS

No sample ID

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
NH4	2.05	1.98	1.78 - 2.18	3.5	108
As	.104	.100	.080 - .118	4	92
Ba	.96	.97	.87 - 1.07	1	94
Cd	.189	.200	.180 - .220	5.5	77
Ca	247	250	225 - 275	1.2	---
Cl	26.16	26.05	24.1 - 27.7	0.4	---
Cr	.201	.200	.180 - .220	0.5	97
Cu	.199	.200	.180 - .220	0.5	93
F	.49	.50	.45 - .55	2.0	116
Fe	.198	.200	.180 - .220	1.0	109
Pb	.204	.200	.180 - .220	2.0	79
Mg	255	250	225 - 275	2.0	---
Mn	.198	.200	.180 - .220	1.0	91
Hg	.005	.005	.004 - .006	0.0	100
Mo	.198	.200	.180 - .220	1.0	91
NO3	2.04	1.98	1.78 - 2.18	3	---
PO4	.49	.50	.46 - .54	2.0	---
K	9.8	10.0	9.0 - 11.0	2.0	86
Se	.022	.025	.017 - .028	13	---
SiO2	1.03	1.07	.96 - 1.18	4.0	114
Ag	.92	.99	.89 - 1.09	7.0	88
Na	256	250	225 - 275	2.4	---
TDS	1430	1479	1331 - 1627	3.4	---
SO4	1051	1000	900 - 1100	5	---
Zn	.189	.200	.180 - .220	5.5	94
Gr.Alpha	167 ± 4	198	178 - 218	15.7	---
Gr.Beta	157 ± 2	179	161 - 197	12.3	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	97 ± 3	99	94 - 104	2.0	---
U	33	34	32 - 36	2.9	---
U(RR)	32	34	32 - 36	5.9	---

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Was faxed from lab, previous 2 pages were not

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different date than previous 2 pages

8-Dec-89

Attn: Phil Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Page: 1
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Authority:
Project :

Purchase order :

Different sample

Job: 891358E Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	As Total mg/l	Ba Total mg/l	CO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l
HER 051	150	0.022	0.01	<1	<0.005	547	39	0.01

Sample	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER 051	3600	<0.01	1.43	4.71	<0.02	201	0.39

Sample	Hg Total mg/l	NO3 as N mg/l	PO4 as P Total mg/l	K Total mg/l	Se Total mg/l	SiO2 mg/l	Ag Total mg/l	Na Total mg/l
HER 051	<0.0002	<0.1	<0.1	31.6	0.023	9.8	<0.01	102

Sample	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*	Gross Beta Total pCi/l	Error 2σ*
HER 051	3220	2280	0.013	78	±21	54	±16

Sample	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HER 051	0.8	±0.3	0.0	±0.4	0.0064

How is the gross alpha 78 pCi/L but U concentration only 6.4 ppb?

6.4

ATTACHMENT 3

SHAFT WATER MONITORING RESULTS

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Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN:

Client No. Log No. 584 Client PO No.

Sample Type: water

Date Collected: 6/27/89 Date Received: 7/5/89 Date Reported: 8/23/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HER045	206	206	<1	.008	.05

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl Total mg/l	Conductance umho/cm	Cu Total mg/l
HER045	<.005	538	35.5	3020	.03

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HER045	1.00	1.17	<.02	150	.06	<.0002

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

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Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN:

LGN: 584

RESULTS OF ANALYSIS (cont'd)

Sample Identification	NO_3 as N mg/l	pH units	PO_4 as P mg/l	K Total mg/l	Se Total mg/l	Ag Total mg/l
HER045	<.1	7.29	<.1	35.2	.015	<.01

Sample Identification	SiO_2 mg/l	Na Total mg/l	TDS mg/l	SO_4 mg/l	Zn Total mg/l	Gross Alpha (Total) pCi/liter Precision*
HER045	9.9	128	3380	2260	.082	4600 ± 100

This gross alpha is far too high for 25 ppb of U

Sample Identification	Gross Beta (Total) pCi/liter ±Precision*	Ra-226 (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/l
HER045	1480 ± 30	480 ± 10	0.7 ± 0.8	0.025

25 ppb

s/b ≈6,900 ppb

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

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Following 8 pages are the same as pages 353-360

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Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	NH4 as N mg/l	As Total mg/l	Ba Total mg/l	HCO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l
HERO 48	150	0.3	0.008	0.02	150	<0.005	542
sump? HERO 49	116	14.5	0.530	0.01	116	<0.005	521
HERO 50	203	0.3	0.006	0.01	203	<0.005	510

Sample	Cl Total mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HERO 48	40	<0.01	3470	<0.01	1.28	11.60	<0.02	186
HERO 49	38	<0.01	3820	0.02	1.35	0.25	0.03	187
HERO 50	38	<0.01	3590	<0.01	0.98	1.11	<0.02	162

Sample	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Total mg/l	Se Total mg/l
HERO 48	0.49	<0.0002	0.02	<0.1	6.92	<0.1	24.2	0.009
HERO 49	0.08	<0.0002	6.45	31.4	6.69	<0.1	36.1	0.017
HERO 50	0.02	<0.0002	0.01	<0.1	7.05	<0.1	36.4	0.011

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AMENDED REPORT

Sample Type: Water

Sample	SiO2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HERO 48	11.5	<0.01	76.0	3440	2280	<0.005	19	±18
HERO 49	11.2	0.02	97.8	3530	2300	0.156	29800	±300
HERO 50	9.9	<0.01	144.0	3320	2190	0.009	1400	±100

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l	
HERO 48	41	±10	3.3	±0.6	0.2	±0.5	0.0041	4.1 ppb
HERO 49	10100	±100	60	±3	710	±20	18.4	18,400 ppb
HERO 50	150	±10	350	±10	1.7	±0.9	0.025	25 ppb

The gross alpha compared to the U concentrations is off

Roughly the gross alpha value in picocuries should be ≈2/3 the uranium concentration value in parts per billion (micrograms per liter)

What method was used that the lab could have measured the U concentration in HERO 48 to 4.1 ppb?

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AMENDED REPORT

Abbreviations:

Analyses:

NH4 as N	: Ammonia
As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
Mo	: Molybdenum
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids

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Page: 4
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Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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18-Dec-89

Bill Almas
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Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 9/27/89 By: T.Moncreif Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH/Zn Acetate
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Swanson	10/5
NH4	1	350.1	0.1 mg/l	2	Hobbs	10/5
As	1	206.2	0.001 mg/l	1	Gilleland	10/4
Ba	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cd	1	200.7	0.005 mg/l	1	Hidalgo	10/20
Ca	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cl	1	325.2	1 mg/l	3	Hobbs	10/4
Cr	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/5
Cu	1	200.7	0.01 mg/l	1	Hidalgo	10/20
F	1	340.2	0.05 mg/l	3	Acree	10/12
Fe	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Pb	1	200.7	0.02 mg/l	1	Hidalgo	10/20
Mg	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Mn	1	200.7	0.01 mg/l	1	Hidalgo	10/20

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Hg	1	245.1	0.0002	mg/l	1	Swanson	10/2
Mo	1	200.7	0.01	mg/l	1	Hidalgo	10/20
NO3	1	353.1	0.1	mg/l	2	Hobbs	10/3
pH	1	210.1	0.01	unit	3	Acree	10/2
PO4	1	365.1	0.1	mg/l	3	Hobbs	10/11
K	1	200.7	0.5	mg/l	1	Hidalgo	10/20
Se	1	270.2	0.001	mg/l	1	Gilleland	10/4
SiO2	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Ag	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Na	1	200.7	0.01	mg/l	1	Hidalgo	10/20
TDS	1	160.1	10	mg/l	3	Acree	10/3
SO4	1	375.3	5	mg/l	3	Acree	10/3
Zn	1	200.7	0.005	mg/l	1	Hidalgo	10/20
Gr.Alpha	4	900.0	1.0	pCi/l	3	Seidel	11/16-12/1
Gr.Beta	4	900.0	2.0	pCi/l	3	Seidel	11/16-12/1
Ra-226	4,7,14	903.0,903.1	0.2	pCi/l	3	Howard	10/31-11/2
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/6-11/10
U	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Tonning	10/17-11/20
U(RR)	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Krizman,Tonning	12/11-12/18

Lowest detection limit is 5 micrograms/liter not 0.3

ASTM International - ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)

Scope:
1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

1.2 The uranium fluorescence is quenched by many cations and some anions in the sample; it is enhanced by a few cations. If interfering ions are present, a direct fluorometric measurement is not suitable, and an extraction method must be used to provide accurate results. The test methods and their concentration ranges are as follows:

Concentration Range, mg/L Sections Test Method A---Direct Fluorometric 0.005 to 2 7 to 15 Test Method B---Extraction 0.04 to 50 16 to 24

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific hazards, see Note 1.

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Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HERO 50	Alkalinity	203	203	0.0
HERO 50	NH4	.34	.34	0.0
HERO 50	As	.006	.006	0.0
HERO 50	Ba	.01	.01	0.0
HERO 50	Cd	<.005	<.005	0.0
HERO 50	Ca	510	511	0.2
HERO 50	Cl	38.2	38.2	0.0
HERO 50	Cr	.01	<.01	---
HERO 50	Sp.Cond.	3590	3590	0.0
HERO 50	Cu	<.01	<.01	0.0
HERO 50	Fe	1.11	1.11	0.0
HERO 50	Pb	<.02	<.02	0.0
HERO 50	Mg	162	161	0.6
HERO 50	Hg	<.0002	<.0002	0.0
HERO 50	Mo	.01	<.01	---
HERO 50	NO3	<.1	<.1	0.0
HERO 50	PO4	<.1	<.1	0.0
HERO 50	K	36.4	36.0	1.0
HERO 50	Se	.010	.011	9
HERO 50	SiO2	9.9	9.9	0.0
HERO 50	Ag	<.01	<.01	0.0
HERO 50	Na	144	143	0.7
HERO 50	Zn	.009	.008	---
HERO 50	U	.025	.025	0.0
HERO 48	U(RR)	.0044	.0039	6.0

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Job: 891214E

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AMENDED REPORT

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
NH4	2.05	1.98	1.78 - 2.18	3.5	108
As	.104	.100	.080 - .118	4	92
Ba	.96	.97	.87 - 1.07	1	94
Cd	.189	.200	.180 - .220	5.5	77
Ca	247	250	225 - 275	1.2	---
Cl	26.16	26.05	24.1 - 27.7	0.4	---
Cr	.201	.200	.180 - .220	0.5	97
Cu	.199	.200	.180 - .220	0.5	93
F	.49	.50	.45 - .55	2.0	116
Fe	.198	.200	.180 - .220	1.0	109
Pb	.204	.200	.180 - .220	2.0	79
Mg	255	250	225 - 275	2.0	---
Mn	.198	.200	.180 - .220	1.0	91
Hg	.005	.005	.004 - .006	0.0	100
Mo	.198	.200	.180 - .220	1.0	91
NO3	2.04	1.98	1.78 - 2.18	3	---
PO4	.49	.50	.46 - .54	2.0	---
K	9.8	10.0	9.0 - 11.0	2.0	86
Se	.022	.025	.017 - .028	13	---
SiO2	1.03	1.07	.96 - 1.18	4.0	114
Ag	.92	.99	.89 - 1.09	7.0	88
Na	256	250	225 - 275	2.4	---
TDS	1430	1479	1331 - 1627	3.4	---
SO4	1051	1000	900 - 1100	5	---
Zn	.189	.200	.180 - .220	5.5	94
Gr.Alpha	167 ± 4	198	178 - 218	15.7	---
Gr.Beta	157 ± 2	179	161 - 197	12.3	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	97 ± 3	99	94 - 104	2.0	---
U	33	34	32 - 36	2.9	---
U(RR)	32	34	32 - 36	5.9	---

Approved by: _____

ATTACHMENT 4

MINE SUMP WATER ANALYSIS

Faxed from Energy Fuels Fredonia office not lab

BARRINGER LABORATORIES INC.

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Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 583 Client PO No.

Sample Type: water

Date Collected: 6/27/89 Date Received: 7/5/89 Date Reported: 8/7/89

RESULTS OF ANALYSIS

Sample Identification	As Total mg/l	Ba Total mg/l	Cd Total mg/l	Cu Total mg/l	Fe Total mg/l	Pb Total mg/l	Mn Total mg/l
HER043	1.09	.03	.014	.04	.29	<.02	.08

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	Se Total mg/l	Ag Total mg/l	Zn Total mg/l
HER043	.0002	12.8	.042	<.01	.123

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER043	4000 ± 100	1100 ± 30	3.31

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 583

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 7/5/89 By: Gina Reichert Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Mercury	1	245.1	0.2 ug/l	1	M. Swanson	7/12/89
Nitrate	1	353.1	0.1 mg/l	2	D. Hobbs	7/12/89
Arsenic	1	206.2	1 ug/l	1	G. Gilleland	7/13/89
Selenium	1	270.2	1 ug/l	1	D. Hobbs	7/14/89
Barium	1	200.7	10 ug/l	1	D. Hidalgo	8/2/89
Cadmium	1	200.7	5 ug/l	1	D. Hidalgo	8/2/89
Copper	1	200.7	10 ug/l	1	D. Hidalgo	8/2/89
Iron	1	200.7	10 ug/l	1	D. Hidalgo	8/2/89
Lead	1	200.7	2 ug/l	1	D. Hidalgo	8/2/89
Manganese	1	200.7	1 ug/l	1	D. Hidalgo	8/2/89
Silver	1	200.7	10 ug/l	1	D. Hidalgo	8/2/89
Zinc	1	200.7	5 ug/l	1	D. Hidalgo	8/2/89
Alpha-Beta	4		1.0,2.0 pCi/l	3	M. Kidwell	7/19-7/31/89
Uranium	4,14		0.3 ug/l	3	Tonning,Krizman	7/19/89

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER043	Mercury	.0002	.0002	0.0%
HER043	Nitrate	12.8	12.8	0.0%
HER043	Arsenic	1.13	1.09	4.0%
HER043	Selenium	.042	.041	2.4%
HER043	Barium	.03	.03	0.0%
HER043	Cadmium	.014	.018	---
HER043	Copper	.04	.04	0.0%

Approved by _____

Barringer Laboratories
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Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 583

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER043	Iron	.29	.29	0.0%
HER043	Lead	<.02	<.02	0.0%
HER043	Manganese	.08	.08	0.0%
HER043	Silver	<.01	<.01	0.0%
HER043	Zinc	.123	.120	0.8%
HER043	Uranium	3.39	3.22	2.6%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Target Range	Relative Deviation From Known	Spike % Recovery
Mercury	.008	.008	.006 - .009	0.0%	100
Nitrate	2.01	1.98	1.78 - 2.18	1.5%	---
Selenium	.022	.025	.017 - .028	13.0%	96
Arsenic	.063	.062	.048 - .078	2.0%	---
Barium	.96	.97	.87 - 1.07	1.0%	96
Cadmium	.212	.200	.180 - .220	6.0%	96
Copper	.206	.200	.180 - .220	3.0%	103
Iron	.208	.200	.180 - .220	4.0%	82
Lead	.203	.200	.180 - .220	1.5%	89
Manganese	.207	.200	.180 - .220	3.5%	102
Silver	.90	.99	.89 - 1.09	9.0%	86
Zinc	.199	.200	.180 - .220	0.5%	108
Gross Alpha	216 ± 4	198	178 - 218	9.1%	---
Gross Beta	175 ± 2	179	161 - 197	2.2%	---
Uranium	1.00	1.00	.95 - 1.05	0.0%	---

Approved by Barbara Copp

BARRINGER LABORATORIES INC.

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18-Dec-89

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Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	NH4 as N mg/l	As Total mg/l	Ba Total mg/l	HCO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l
HERO 48	150	0.3	0.008	0.02	150	<0.005	542
HERO 49	116	14.5	0.530	0.01	116	<0.005	521
HERO 50	203	0.3	0.006	0.01	203	<0.005	510

Sample	Cl Total mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HERO 48	40	<0.01	3470	<0.01	1.28	11.60	<0.02	186
HERO 49	38	<0.01	3820	0.02	1.35	0.25	0.03	187
HERO 50	38	<0.01	3590	<0.01	0.98	1.11	<0.02	162

Sample	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Total mg/l	Se Total mg/l
HERO 48	0.49	<0.0002	0.02	<0.1	6.92	<0.1	24.2	0.009
HERO 49	0.08	<0.0002	6.45	31.4	6.69	<0.1	36.1	0.017
HERO 50	0.02	<0.0002	0.01	<0.1	7.05	<0.1	36.4	0.011

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Sample Type: Water

	Sample	SiO2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
well?	HERO 48	11.5	<0.01	76.0	3440	2280	<0.005	19	±18
sump	HERO 49	11.2	0.02	97.8	3530	2300	0.156	29800	±300
shaft	HERO 50	9.9	<0.01	144.0	3320	2190	0.009	1400	±100

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HERO 48	41	±10	3.3	±0.6	0.2	±0.5	0.0041
HERO 49	10100	±100	60	±3	710	±20	18.4
HERO 50	150	±10	350	±10	1.7	±0.9	0.025

Not possible to have 1,400 pCi/L and only 25 ppb of uranium - should be over 2,000 ppb

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Job: 891214E Status: Final

AMENDED REPORT

Abbreviations:

Analyses:

NH4 as N	: Ammonia
As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
Mo	: Molybdenum
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids

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SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

Gary Zito
Laboratory Supervisor

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QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 9/27/89 By: T.Moncreif Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH/Zn Acetate
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Swanson	10/5
NH4	1	350.1	0.1 mg/l	2	Hobbs	10/5
As	1	206.2	0.001 mg/l	1	Gilleland	10/4
Ba	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cd	1	200.7	0.005 mg/l	1	Hidalgo	10/20
Ca	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cl	1	325.2	1 mg/l	3	Hobbs	10/4
Cr	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/5
Cu	1	200.7	0.01 mg/l	1	Hidalgo	10/20
F	1	340.2	0.05 mg/l	3	Acree	10/12
Fe	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Pb	1	200.7	0.02 mg/l	1	Hidalgo	10/20
Mg	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Mn	1	200.7	0.01 mg/l	1	Hidalgo	10/20

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Hg	1	245.1	0.0002	mg/l	1	Swanson	10/2
Mo	1	200.7	0.01	mg/l	1	Hidalgo	10/20
NO3	1	353.1	0.1	mg/l	2	Hobbs	10/3
pH	1	210.1	0.01	unit	3	Acree	10/2
PO4	1	365.1	0.1	mg/l	3	Hobbs	10/11
K	1	200.7	0.5	mg/l	1	Hidalgo	10/20
Se	1	270.2	0.001	mg/l	1	Gilleland	10/4
SiO2	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Ag	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Na	1	200.7	0.01	mg/l	1	Hidalgo	10/20
TDS	1	160.1	10	mg/l	3	Acree	10/3
SO4	1	375.3	5	mg/l	3	Acree	10/3
Zn	1	200.7	0.005	mg/l	1	Hidalgo	10/20
Gr.Alpha	4	900.0	1.0	pCi/l	3	Seidel	11/16-12/1
Gr.Beta	4	900.0	2.0	pCi/l	3	Seidel	11/16-12/1
Ra-226	4,7,14	903.0,903.1	0.2	pCi/l	3	Howard	10/31-11/2
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/6-11/10
U	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Tonning	10/17-11/20
U(RR)	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Krizman,Tonning	12/11-12/18

This method only had LLD to 5 micrograms/liter not 0.3

ASTM-D2907 › Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope
1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

1.2 The uranium fluorescence is quenched by many cations and some anions in the sample; it is enhanced by a few cations. If interfering ions are present, a direct fluorometric measurement is not suitable, and an extraction method must be used to provide accurate results. The test methods and their concentration ranges are as follows:

Concentration Range, mg/L Sections Test Method A---Direct Fluorometric 0.005 to 2 7 to 15 Test Method B---Extraction 0.04 to 50 16 to 24
1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific hazards, see Note 1.

https://www.document-center.com/standards/show/ASTM-D2907

BARRINGER LABORATORIES INC.

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1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

18-Dec-89

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HERO 50	Alkalinity	203	203	0.0
HERO 50	NH4	.34	.34	0.0
HERO 50	As	.006	.006	0.0
HERO 50	Ba	.01	.01	0.0
HERO 50	Cd	<.005	<.005	0.0
HERO 50	Ca	510	511	0.2
HERO 50	Cl	38.2	38.2	0.0
HERO 50	Cr	.01	<.01	---
HERO 50	Sp.Cond.	3590	3590	0.0
HERO 50	Cu	<.01	<.01	0.0
HERO 50	Fe	1.11	1.11	0.0
HERO 50	Pb	<.02	<.02	0.0
HERO 50	Mg	162	161	0.6
HERO 50	Hg	<.0002	<.0002	0.0
HERO 50	Mo	.01	<.01	---
HERO 50	NO3	<.1	<.1	0.0
HERO 50	PO4	<.1	<.1	0.0
HERO 50	K	36.4	36.0	1.0
HERO 50	Se	.010	.011	9
HERO 50	SiO2	9.9	9.9	0.0
HERO 50	Ag	<.01	<.01	0.0
HERO 50	Na	144	143	0.7
HERO 50	Zn	.009	.008	---
HERO 50	U	.025	.025	0.0
HERO 48	U(RR)	.0044	.0039	6.0

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Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

How is there a known for random samples?

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
NH4	2.05	1.98	1.78 - 2.18	3.5	108
As	.104	.100	.080 - .118	4	92
Ba	.96	.97	.87 - 1.07	1	94
Cd	.189	.200	.180 - .220	5.5	77
Ca	247	250	225 - 275	1.2	---
Cl	26.16	26.05	24.1 - 27.7	0.4	---
Cr	.201	.200	.180 - .220	0.5	97
Cu	.199	.200	.180 - .220	0.5	93
F	.49	.50	.45 - .55	2.0	116
Fe	.198	.200	.180 - .220	1.0	109
Pb	.204	.200	.180 - .220	2.0	79
Mg	255	250	225 - 275	2.0	---
Mn	.198	.200	.180 - .220	1.0	91
Hg	.005	.005	.004 - .006	0.0	100
Mo	.198	.200	.180 - .220	1.0	91
NO3	2.04	1.98	1.78 - 2.18	3	---
PO4	.49	.50	.46 - .54	2.0	---
K	9.8	10.0	9.0 - 11.0	2.0	86
Se	.022	.025	.017 - .028	13	---
SiO2	1.03	1.07	.96 - 1.18	4.0	114
Ag	.92	.99	.89 - 1.09	7.0	88
Na	256	250	225 - 275	2.4	---
TDS	1430	1479	1331 - 1627	3.4	---
SO4	1051	1000	900 - 1100	5	---
Zn	.189	.200	.180 - .220	5.5	94
Gr.Alpha ???	167 ± 4	198	178 - 218	15.7	---
Gr.Beta	157 ± 2	179	161 - 197	12.3	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	97 ± 3	99	94 - 104	2.0	---
U	33	34	32 - 36	2.9	---
U(RR)	32	34	32 - 36	5.9	---

205 ppCi/L

Ra226 and Th230 is greater than gross alpha and and U decay is greatest contributor to gross alpha

Approved by:

HERMIT MINE
PREMINING
WATER QUALITY
REPORT

TO

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

SUBMITTED

BY

ENERGY FUELS NUCLEAR, INC.
ONE TABOR CENTER
1200 SEVENTEENTH STREET, SUITE 2500
DENVER, COLORADO 80202

FEBRUARY 12, 1990



Exhibit 2
4/28/88
12/23/88
5/31/89
6/29/89
9/29/89

Missing
6/28/88
9/27/88
12/22/88

? <

Hermit Mine
Premining
Water Quality Data Report

Pursuant to Requirements
Contained Within Groundwater Protection Permit G-0035-08

Premining Water Quality Baseline Determination

Pre-mining groundwater samples were not collected from well 55-518877

During the period between construction of the surface facility and mining activity, five quarterly samples from the Monitor/Production Well identified as Well Registry #55-518877 were collected and analyzed. Four of the quarterly samples have been submitted previously to the Arizona Department of Environmental Quality. Sample results from the fifth quarterly sample are included in this Report as Exhibit 1.

Pursuant to requirements contained within the Hermit Mine Groundwater Protection Permit, the premining mean average concentration and sample standard deviation were calculated for parameters specified in part II.B.2.b. These calculations provide a water quality baseline and establish Maximum Groundwater Limits for monitor well samples during the mining phase. A summary of the analytical results making up the premining baseline and calculations are shown on Exhibit 2.

Groundwater Inflow to Shaft and Mine Development Workings

Exhibit 3 illustrates mine inflows for the premining period. Groundwater was initially encountered during shaft sinking on June 15, 1988. Groundwater was first encountered 902 feet below the shaft collar elevation (3,984 feet MSL) at the Coconino sandstone-Toroweap limestone formation contact. Inflows were estimated at 2 gpm based on pump capacity and operating hours. Inflow steadily increased from 2 gpm to 15 gpm as shaft construction proceeded to 942 feet below shaft collar elevation

(3944 feet MSL). The unsaturated Hermit shale contact was encountered at this elevation and no additional saturated zones were encountered during shaft construction. During July, 1988, a grouting program was initiated at the Coconino-Hermit formation contact which effectively reduced inflow to about 7 gpm. Thereafter, groundwater inflows to the shaft and development mine workings increased steadily due principally to development of a mine adit at the 3970 feet MSL elevation. This adit was driven off the main shaft, following the Coconino-Toroweap formation contact outside of the breccia pipe. Development of the mine adit significantly increased total surface area open to groundwater inflow resulting in increased flow. Total mine water was made up almost entirely of water from the Coconino-Toroweap formations with only an estimated 2 gpm entering the mine development workings at all other locations.

Well 517832 is 975' deep, depth to water: 903' bsc

A groundwater sampling monitor point was established at an elevation of 908 feet below the shaft collar at an elevation of 3976 feet MSL. The monitor point is a diamond drill core hole which penetrates the Coconino and Toroweap formations. Analytical information from water collected from this zone has been presented in previous quarterly reports, specifically, samples HR023 and HR033. Second Quarter, 1989 Shaft Water Analysis results are identified as HER 042 in Exhibit 1. The approximate location of the monitoring point is identified on Plate 1.

Mine Configuration

The development of the surface plant was performed in accordance with the approved Plan of Operations submitted to the Bureau of Land Management as described in the Hermit Mine Notice of Intent to Mine filed with the ADEQ. A total of approximately 24 acres has been disturbed, including two water evaporation ponds. Plate 2 illustrates the current surface plant configuration.

Underground workings, as of June 30, 1989, are illustrated in a side view in Plate 1.

Permeability of the Mine Sump **Sump was not lined**

As part of the documentation needed for the application for the Groundwater Protection Permit at the Hermit Mine, EFN contracted with Canonie Environmental Services Corporation (Canonie) to assess potential impacts to groundwater at the site. The report, "Potential Impacts of Mining on Groundwater Resources", was submitted January, 1988. In part, the study looked at the permeability porosity and specific retention of rock within the breccia pipe and in surrounding formations. Rock core samples were obtained from the mining zone and the zones below mining both inside and outside of the pipe. Care was taken to select rock samples representative of the rocks surrounding the mining zone. **Canonie used the rock permeability from Canon Mine, not for Hermit Mine and is not for the Hermit Shale**

Core material selected for determining Hermit shale permeability was obtained at approximately the same elevation, and within 500 feet, of the Hermit mine sump. Canonie concluded that Hermit shale and breccia material are essentially impermeable with gas permeabilities ranging from a 10^{-8} cm/sec. to 10^{-9} cm/sec. This range represents values one to two orders of magnitude below the levels at which materials are commonly considered impermeable for hydrogeological and geotechnical engineering applications.

A copy of the portion of the report, which discusses physical parameters influencing migration of mine water, is attached as Exhibit 4.

EXHIBIT I

SECOND QUARTER, 1989
WATER QUALITY ANALYSIS

BARRINGER LABORATORIES INC.

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Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

HER041 - well
HER042 - shaft

ATTN: Larry Casebolt

Client No. Log No. 344 Client PO No.

Sample Type: water

Date Collected: 5/31/89 Date Received: 6/2/89 Date Reported: 7/21/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HER041	159	159	<1	.006	<.01
HER042 shaft	209	209	<1	.007	<.01
PN040	204	204	<1	<.001	.01

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance umhos/cm	Cu Total mg/l
HER041	.005	546	39.6	.01	3200	.02
HER042 shaft	.005	514	28.4	.02	3170	.02
PN040	.005	181	20.1	<.01	1860	.02

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	NO_3 as N mg/l
HER041	1.26	9.85	<.02	187	.17	.0002	<.1
HER042 shaft	1.07	1.01	<.02	166	.05	.0003	<.1
PN040	.73	8.52	<.02	127	.51	.0002	<.1

Approved by D. Fahn

Barringer Laboratories
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(303) 277-1687

Energy Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

Sample Identification	pH units	PO_4 as P mg/l	K Total mg/l	Se Total mg/l	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l
HER041	7.59	<.1	25.7	.018	12.1	<.01	82.0
HER042	7.68	<.1	32.8	.019	9.37	<.01	134
PN040	7.84	<.1	28.9	.016	8.68	<.01	79.8

Sample Identification	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l	S mg/l	Ra-226 (Total) pCi/liter ±Precision*
HER041	3470	88	2360	.015	<2	1.2 ± 0.4
HER042	3360	<4	2190	.055	<2	230 ± 10
PN040	1610	66	1010	.036	<2	15 ± 1

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER041 well	14 ± 20	39 ± 11	0.0 ± 0.5	0.0029
HER042 spring	1600 ± 100	400 ± 20	0.1 ± 0.4	~~0.0245~~
PN040	65 ± 14	44 ± 6	0.1 ± 0.4	0.0067

s/b ≈0.1 mg/L if alpha correct

Gross beta would not be higher than gross alpha, U concentration too low for stated gross alpha

14 pCi/L ≈ 0.02 mg/L not 0.0029
65 pCi/L ≈ 0.1 mg/L

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

See pages 1,010 & 1,011

Approved by D. Larson

Barringer Laboratories
15000 W. 6th Avenue
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(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET

Time Received: 9:30 Date: 6/2/89 By: Gina Reichert Via: Fed. Express

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Nitrate	1	353.1	0.1 mg/1	2	D. Hobbs	6/6/89
Chloride	1	325.2	0.2 mg/1	3	D. Hobbs	6/7/89
Phosphate	1	365.1	0.01 mg/1	3	D. Hobbs	6/12/89
Mercury	1	245.1	0.2 ug/1	1	M. Swanson	6/15/89
Barium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Cadmium	1	200.7	5 ug/1	1	D. Hidalgo	6/19/89
Calcium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Chromium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Copper	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Iron	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Lead	1	200.7	2 ug/1	1	D. Hidalgo	6/19/89
Magnesium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Manganese	1	200.7	1 ug/1	1	D. Hidalgo	6/19/89
Potassium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Silica	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Selenium	1	270.2	1 ug/1	1	G. Gilleland	6/23/89
Conductance	1	120.1	0.1 umhos/cm	3	A. Knudson	6/26/89
Alkalinity	1	210.1	0.5 mg/1	3	M. Swanson	6/26/89
Arsenic	1	206.2	1 ug/1	1	G. Gilleland	6/27/89
pH	1	150.1	0.01 units	3	A. Knudson	6/28/89
Fluoride	1	340.2	0.1 mg/1	3	A. Knudson	6/29/89
Silver	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Sodium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Zinc	1	200.7	5 ug/1	1	D. Hidalgo	6/19/89
TSS	1	160.2	4 mg/1	3	A. Knudson	6/26/89
TDS	1	160.1	10 mg/1	3	A. Knudson	6/26/89
Sulfate	1	375.3	0.1 mg/1	3	A. Knudson	6/26/89

Approved by D. Parker

Barringer Laboratories
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Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Sulfite	1	377.1	1 mg/1	3	A. Knudson	6/28/89
Alpha-Beta	4		1.0,2.0 pCi/1	3	M. Kidwell	7/6-7/12/89
Radium 226	4,7		0.2 pCi/1	3	Howard, Barkey	7/7-7/13/89
Thorium 230	11		0.2 pCi/1	3	Jackson, Ortiz	6/29-7/7/89
Uranium	4,14		0.3 ug/1	3	Tonning,Krizman	7/7-7/10/89

These are mostly for Pinenut Mine

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
PN040	Nitrate	<.1	<.1	0.0%
PN040	Chloride	20.1	20.1	0.0%
PN040	Phosphate	<.1	<.1	0.0%
PN040	Mercury	.0002	.0003	---
PN040	Barium	.01	.01	0.0%
PN040	Cadmium	<.005	<.005	0.0%
PN040	Calcium	181	180	0.6%
PN040	Chromium	<.01	<.01	0.0%
PN040	Copper	.02	.02	0.0%
PN040	Iron	8.52	8.45	0.8%
PN040	Lead	<.02	<.02	0.0%
PN040	Magnesium	127	126	0.8%
PN040	Manganese	.51	.51	0.0%
PN040	Potassium	28.9	28.5	1.4%
PN040	Silica	8.68	8.64	0.5%
PN040	Selenium	.019	.020	5.0%
HER042	Conductance	3170	3170	0.0%
PN040	Alkalinity	203	205	1.0%
PN040	Arsenic	<.001	<.001	0.0%
PN040	pH	7.84	7.83	0.1%
HER041	Fluoride	1.24	1.27	2.4%
PN040	Silver	<.01	<.01	0.0%
PN040	Sodium	79.8	78.9	1.1%
PN040	Zinc	.036	.036	0.0%
PN040	TSS	65	67	3.0%

Approved by D Rankin

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Energy Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER041	TDS	3470	3480	0.3%
HER042	Sulfate	2160	2230	3.2%
HER042	Sulfite	<2	<2	0.0%
PN040	Uranium	0.0069	0.0064	3.8%

QUALITY CONTROL STANDARDS

What "Known"?
This is recycled from the Lab Accuracy test

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Nitrate	2.14	1.98	1.78 - 2.18	7.8%	---
Chloride	25.6	26.05	24.1 - 27.7	1.6%	---
Phosphate	.47	.50	.46 - .54	6.2%	---
Mercury	.006	.005	.004 - .006	---	100
Barium	.92	.97	.87 - 1.07	5.0%	91
Cadmium	.197	.200	.180 - .220	1.5%	99
Calcium	243	250	225 - 275	2.8%	---
Chromium	.196	.200	.180 - .220	2.0%	98
Copper	.205	.200	.180 - .220	2.5%	100
Iron	.199	.200	.180 - .220	0.5%	---
Lead	.194	.200	.180 - .220	3.0%	93
Magnesium	.197	.200	.180 - .220	1.5%	---
Manganese	.197	.200	.180 - .220	1.5%	95
Potassium	9.31	10.0	9.0 - 11.0	6.9%	82
Silica	.97	1.07	.96 - 1.18	9.0%	---
Selenium	.025	.025	.017 - .028	0.0%	88
Arsenic	.099	.100	.080 - .118	1.0%	76
Fluoride	.48	.50	.45 - .55	4.1%	90
Silver	.90	.99	.89 - 1.09	9.0%	86
Sodium	253	250	225 - 275	1.2%	---
Zinc	.203	.200	.180 - .220	1.5%	107
TDS	1490	1470	1331 - 1627	0.7%	---
Sulfate	1067	1000	900 - 1100	6.7%	---
Gross Alpha	210 ± 4	198	178 - 218	6.1%	---
Gross Beta	168 ± 1	179	161 - 197	6.1%	---
Radium 226	95 ± 2	101	96 - 106	6.0%	---
Thorium 230	99 ± 3	99	94 - 104	0.0%	---

Approved by D. Fahn

Barringer Laboratories
15000 W. 6th Avenue
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(303) 277-1687

Energu Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS (cont'd)

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Mean	Spike % Recovery
Uranium	33	34	32 - 36	2.9%	---

For what sample and what units?

Approved by D. Parker

SEND TO: BARRINGER LABS
15,000 WEST 6TH AVE SUITE 300
GOLDEN, COLORADO 80401

CHAIN OF CUSTODY RECORD - CLIENT COPY

SENT FROM:

Sampler's Name: LAWRENCE L. CASEROLT
Company Name: ENERGY FUELS NUCLEAR, INC
Company Address: P.O. BOX 36 FREDONIA, AZ. 86022

I.D. #	Client I.D. #	Sample Location	Date/Time of Sampling	Raw, Unfiltered, Plastic	Raw, Filtered, Plastic	Raw, Filtered, Glass	HNO_3, Filtered, Plastic	H_2SO_4, Filtered, Plastic	NaOH + Zn Acetate, Filtered, Plastic			Total Number of Bottles	(Instructions for Analysis on back of form) Comments
	HER041	HERMIT MINE WATER WELL	5/31/89 / 3:53 PM	1			1	1	1			4	✓
	HER042	HERMIT MINE SHAFT	5/31/89 / 5:00 PM	1			1	1	1			4	✓
	PN040	PINENUT MINE WATER WELL	5/31/89 / 12:17 PM	1			1	1	1			4	✓

Relinguished By: (Signature)	Date/Time	Received By: (Signature)	Date/Time
Lawrence L. Caserolt	6-1-89 / 9:30 AM	Dina Reichert	6/2/89 9:30 A.M.
Relinguished By: (Signature)	Date/Time	Received for BLI By: (Signature)	Date/Time

Shipping Information
Carrier: FEDERAL EXPRESS
Date Shipped: 6-1-89

Is there a FedEx document to verify this Chain of Custody?

	A	B	C	D	E	F	G	H	I
1	PARAMETER,UNIT	HR 012	HR 019	HR 025	HR 032	HER 041	PREMINING	SAMPLE STANDARD	MAXIMUM ACCEPTABLE
2		04-28-88	~~06-29-89~~ 06-29-88	~~09-29-89~~ 09-29-88	12-23-88	05-31-89	SAMPLE MEAN	DEVIATION	VALUE
3									
4	As,mg/l	0.013	0.015	0.02	0.006	0.006	0.012	0.0060	0.0241
5	Ba,mg/l	0.01	0.02	0.04	0.04	0	0.022	0.0179	0.0578
6	Cd,mg/l	0	0.025	0	0	0	0.005	0.0112	0.0274
7	Cu,mg/l	0.01	0.02	0.02	0.04	0.02	0.022	0.0110	0.0439
8	Fe,mg/l	4.03	7.48	6.21	7.33	9.85	6.98	2.1157	11.2114
9	Pb,mg/l	0	0.15	0	0	0	0.03	0.0671	0.1642
10	Mn,mg/l	0.06	0.11	0.09	0.1	0.17	0.106	0.0404	0.1867
11	Hg,mg/l	0.0011	0.0011	0.0003	0	0.0002	0.00054	0.0005	0.0016
12	Se,mg/l	0.009	0	0.037	0.012	0.018	0.0152	0.0138	0.0428
13	Ag,mg/l	0.01	0.02	0.02	0	0	0.01	0.0100	0.0300
14	Zn,mg/l	0	0.118	0.07	0.136	0.015	0.0678	0.0603	0.1885
15	U,mg/l	0.0025	0.0025	0.0022	0.0024	0.0029	0.0025	0.0003	0.0030
16	Alk as CaCO3,mg/l	159	155	157	157	159	157.4	1.6733	160.7466
17	HCO3 as CaCO3	159	155	157	157	159	157.4	1.6733	160.7466
18	CO3,mg/l	0	0	0	0	0	0	0.0000	0.0000
19	Ca,mg/l	585	577	494	533	546	547	36.5718	620.1437
20	Cl,mg/l	43	41	42.3	40.1	39.6	41.2	1.4370	44.0740
21	Cr,mg/l	0.1	0.15	0.13	0.01	0.01	0.08	0.0663	0.2127
22	F,mg/l	1.47	1.39	1.32	1.41	1.26	1.37	0.0815	1.5331
23	Mg,mg/l	183	192	169	177	187	181.6	8.9331	199.4662
24	PO4,mg/l	0	0	0	0	0	0	0.0000	0.0000
25	K,mg/l	25.3	24.4	19.4	21.6	25.7	23.28	2.6957	28.6715
26	SiO2,mg/l	13.6	12.8	11	12.6	12.1	12.42	0.9602	14.3404
27	Na,mg/l	70.1	78.8	69.5	73.6	82	74.8	5.4649	85.7298
28	SO4,mg/l	2230	2240	2080	2220	2360	2226	99.3982	2424.7964
29	TDS,mg/l	3500	3450	3430	3430	3470	3456	29.6648	3515.3296
30	NO3 as N,mg/l	0.7	0	0	0	0	0.14	0.3130	0.7661
31	Gross alpha, pCi/l	0	0	76	12	14	20.4	31.7616	83.9232
32	Gross beta, pCi/l	31	27	38	30	39	33	5.2440	43.4881
33	Th230, pCi/l	0	0.7	0.4	0.6	0	0.34	0.3286	0.9973
34	Ra226,mg/l	3.5	2.6	0.4	2.1	1.2	1.96	1.2054	4.3708
35	Electrical conductiv	3430	3210	3340	3440	3200	3324	115.4556	3554.9112
36	umhos/cm								0.0000
37	pH,units	8.02		7.2	7.4	7.59	7.5525	0.3500	8.2525
38	TSS,mg/l	18		14	9	88	32.25	37.3486	106.9472

EXHIBIT #2

Hermit Mine Premining Groundwater Quality

EXHIBIT 3
Premining Groundwater Inflow

Pumping Record
June, 1988 to May, 1989(1)

Month		GPM	
June	1988	129,600	
July	1988	432,000	
August	1988	302,400	
September	1988	446,400	
October	1988	535,700	
November	1988	505,440	
December	1988	580,320	average ≈13 gal/minute
January	1989	631,656	≈14 gal per minute
February	1989	486,085	
March	1989	522,946	
April	1989	350,788	
May	1989	526,910	≈12 gpm

gallon per month?

(1) Pumping rates estimated using pump capacity and hours of operation for 1988. A totalizing flow meter was installed in January, 1989 and used thereafter.

GW first encountered during shaft sinking on 6/15/88 at 902 ft below collar elev.

There was perched groundwater encountered during exploration drilling

EXHIBIT 4

A PORTION OF THE REPORT

"POTENTIAL IMPACTS OF MINING ON GROUND WATER RESOURCES"

PREPARED BY CANONIE ENVIRONMENTAL SERVICES

2.0 NATURAL FACTORS RESTRICTING MINE SEEPAGE MIGRATION

2.1 Physical Parameters

At the Hermit Mine site, physical parameters are the primary mechanisms that will restrict migration of seepage from the mine workings and shaft. These parameters include the following:

- o Permeability - Permeability, in particular vertical permeability, is the most important factor because it is the primary mechanism that will control the rate and distance seepage may migrate into the underlying strata.

- o Porosity - Porosity is a major factor which determines the magnitude of permeability and controls the amount of seepage that can be contained within the strata below the mine and shaft.

- o Specific Retention - Specific retention determines the amount of seepage that could be stored in the strata after the seepage has drained by gravity from the pores.

These parameters were evaluated by laboratory testing and field observation. Laboratory testing was conducted on core samples of Hermit Shale and of the breccia pipe from the Hermit deposit. The testing included air permeability, Klinkenberg permeability, porosity, and specific retention. The results of the laboratory testing are presented in Table 3 and a description of laboratory test procedures is presented in Appendix B.

Field observations included visits to two active mine sites and review of cores, geophysical, and lithological logs for the borings at the Hermit Mine site in May, 1987. The two mines visited were Kanab North and Pigeon. Figure 1 shows the location of these mines in relation to the Hermit Mine site.

2.1.1 Permeability

The permeability of the Hermit Shale and the breccia material was estimated in the laboratory using two procedures: air permeability and Klinkenberg permeability. The air permeability test is a common procedure used for evaluating rock samples. However, this provides an extremely conservative estimate of permeability. Actual liquid permeability would be lower than the calculated air permeability because of the higher viscosity of water compared to air. Since liquid permeability testing could not be conducted on the samples because the material was too impermeable to provide results, the Klinkenberg permeability test was conducted.

The Klinkenberg permeability test also utilizes a gas, but the results of the procedure, which measures the amount of gas slippage, correlate with given values of liquid permeability (Freeman and Bush, 1981, and Aronofsky, 1952). Even the Klinkenberg test may provide a conservative estimate of liquid permeability because the test does not account for chemical reactions between the rock and the liquid (Freeman and Bush, 1981). These reactions would further reduce the rate a fluid could migrate through a rock material. According to studies, the value of permeability using the Klinkenberg test may be 0.3 to 0.7 times higher than the actual liquid permeability (Freemand and Bush, 1981).

Field observations and laboratory data both show that the Hermit Shale and breccia pipe material are essentially impermeable. The strata exposed in the two operating mines (i.e., the Pigeon and Kanab North) was very tight and dry. As shown in Table 3, laboratory-determined air permeabilities for core samples of the breccia pipe were approximately 10^{-8} cm/sec and for the Hermit Shale were 10^{-9} cm/sec. These values are one to two orders of magnitude below the levels at which materials are commonly considered impermeable for hydrogeological and geotechnical engineering applications (Freeze and Cherry, 1979; Fetter, 1980; U.S. Dept. of Interior, 1981; Lambe and Whitman, 1969; Holtz and Kovacs, 1981; Sowers and Sowers, 1961). Furthermore, these values provide an extremely conservative estimate of

permeability since actual liquid permeability would be lower than calculated air permeability because of the higher viscosity of water compared to air.

The results of the Klinkenberg permeability testing, presented in Table 3, show that the estimated horizontal liquid permeability of the Hermit Shale was 10^{-10} cm/sec and the estimated vertical liquid permeability for the Hermit Shale were below the detection limit of the equipment, or at least 10^{-11} cm/sec. These estimated values may be lower depending on the effect of chemical reaction between the seepage and the rock. The vertical permeability is the most important value because it will control the rate of vertical migration of any liquids from the bottom of the mine and shaft. This value of vertical permeability is closer to the range of values determined in the laboratory for core samples from the Canyon Mine which averaged 8×10^{-11} cm/sec for Hermit Shale and 4×10^{-9} cm/sec for the breccia below the proposed depth of mining (Dames and Moore, 1987, after Core Lab).

An estimate of the distance seepage is predicted to migrate was made based on the laboratory-derived estimate of permeability and the rate and volume of inflow estimated from the data collected at the Pigeon Mine and trends reported for the Hack Canyon and Kanab North mines. The evaluation used both the overly conservative vertical gas permeability of 10^{-8} cm/sec and the more realistic Klinkenberg permeability value of 10^{-11} cm/sec to bracket the possible range of distances over which the seepage would be expected to migrate. The total volume of water (12 million gallons) available for seepage was estimated, based on inflows of ten gpm for one year and two gpm for six years.

Seepage migration was estimated using Darcy's law where the rate of migration is a function of the gradient and the permeability of the strata through which the fluid is migrating. Darcy's Law is the most commonly used expression for estimating fluid flow through porous material. Appendix C presents a description of the equations used.

The calculations indicate that using a vertical permeability of 10^{-11} cm/sec and 10^{-8} cm/sec, the seepage front could migrate a maximum distance of up to 0.07 feet below the shaft during the anticipated seven years of mine operation. These calculations provide a conservative estimate of the time and location of the seepage front because it was assumed that the following conditions will exist:

- All inflow to the mine will be ponded in the sump and will provide a constant source of water for seepage for the duration of operations. However, as demonstrated previously, the inflow to the mine and shaft is not expected to remain constant. Rather, it is expected to cease by the end of the operation.

- Both Darcy's Law and the vertical permeability value used are for saturated conditions. However, laboratory testing and visual observation indicated that the Hermit Shale was only partially saturated. Since the permeability of a partially saturated material increases with increasing water content (Freeze and Cherry, 1979, and Fetter, 1980), using the saturated permeability will result in higher infiltration rates and greater estimated distance for seepage migration than with an unsaturated permeability value.

After mining operations cease, all existing inflows to the shaft will be sealed with bentonite. Therefore, no additional inflow to the mine is expected. Since the source and driving head of seepage migration will be removed, further vertical migration of seepage will be due to gravity drainage of the seepage that has saturated less than one foot of the underlying strata.

However, if inflow to the mine or shaft continued after mining operations cease, the seepage would continue to migrate at a rate ranging from 0.2 feet per year (using a conservative permeability of 10^{-8} cm/sec) to 2 x 10^{-4} feet per year (using a more realistic permeability of 10^{-11} cm/sec). At these rates, and assuming a constant source of seepage, seepage could

migrate the 1,600 feet to the top of the Redwall-Muav aquifer in a period ranging from an overly conservative estimate of eight thousand years to a more realistic estimate of eight million years.

Fracture Permeability

Small-scale fracture permeability was evident in the two operating mines within the breccia pipe. During drilling and blasting operations, partially open fractures were intersected and water seeped out of the fractures at an estimated rate of less than 0.1 gpm. Apparently, the fractures are hydraulically discontinuous, and seepage from the fractures generally ceases within a period of a week or a month. No fracture permeability was identified in the Hermit Shale outside the pipes. Review of the geophysical and lithological logs and core from the Hermit Mine site indicated that this site will have similar small-scale fracture permeability to that seen in the two operating mines.

Large-scale fracture permeability resulting from faulting is not expected at the Hermit Mine site. Review of the logs and core as well as discussions with the exploration drilling operator provided no evidence of large-scale fracturing/faulting that could be a conduit for seepage migration from the mine to the Redwall-Muav aquifer. If a large-scale fracture/fault was present, it would have been identified during exploration drilling because of the dense spacing of boreholes at the site.

To evaluate the improbability of the presence of a large-scale fracture/fault at the site, a set of hypothetical faults was superimposed on existing site borehole information. The results of the evaluation show that only at two locations at the site are the borings spaced far enough apart that an almost vertical hypothetical fault or fracture would not be intersected by the borings. Figure 5 shows the locations of these two hypothetical features. Projection of a hypothetical fault/fracture plane from the ground surface traced along the alignment of Boring HU-536-025 (Fault A) and Boring HU-536-013 (Fault B) to the alignment of the bottom elevation of

the most distant boring (Boring HU-536-021 and Boring HU-536-011) indicates that two fault planes dipping at greater than 82° and 86° toward the southwest are the only features that would not be intersected by one of the exploration borings. Furthermore, these hypothetical faults would have to be oriented obliquely to the concentric fracture pattern within the breccia pipe structure evident from the surface geologic map presented on Figure 5.

Additional supporting evidence which indicates that there are no large-scale fractures or faults intersecting the site is the water level and water quality data obtained from the pumping test conducted at the site in February, 1987. As discussed in Section 1.4, water levels inside and outside the pipe showed a 100- to 200-foot difference in elevation, and concentrations of radionuclides were significantly higher inside as compared with outside the pipe. Also, as discussed in Section 1.3, there is no evidence of faulting in terms of deformation or offset of bedding that might be attributed to major fault displacement.

2.1.2 Porosity and Specific Retention

Porosity

The porosity of the Hermit Shale and the breccia material was estimated by laboratory testing. Table 3 shows the results of the testing and Appendix B presents the laboratory procedures. As expected, the Hermit Shale has a slightly lower porosity of five percent as compared to eight percent for the breccia material. These values are typical for impermeable shale and cemented rock materials (Freeze and Cherry, 1979; and Fetter, 1980).

Specific Retention

A percentage of the seepage which may saturate the strata below the mine and shaft will be retained in the pore spaces after gravity drains the free water. This water is held in the pore spaces of the rock by surface tension and is called specific retention. The sum of the specific retention

and the water that drains due to gravity is equal to the porosity. Specific retention increases with decreasing grain size because of the increased ratio of surface area to volume. Therefore, the specific retention of the Hermit Shale and the more silty portions of the breccia material are expected to be at least half of the total porosity (Fetter, 1980). An estimate of the specific retention of the Hermit Shale and the breccia material was made by conducting thermogravimetric analyses of core samples. The results are presented in Table 3 and the laboratory procedures are presented in Appendix B.

The results presented in Table 3 show that approximately 1.0 percent of the weight or 2.6 percent of the volume of the samples was pore water. Since the samples were visibly dry when tested, the water lost would represent water retained in the pores by specific retention. The actual value of specific retention is probably higher, but it is at least between three and eight percent of the total volume of the rock for the breccia and between three and five percent for the Hermit Shale. For the purpose of this evaluation, the specific retention was assumed to be half of the pore space that was not already filled with water or one percent of the total pore volume.

Estimated migration of seepage after mining operations cease was calculated using a one-dimensional piston flow model assuming that all the water estimated to saturate up to 0.07 feet of shale below the shaft during mining would drain except that held by specific retention. The water that drains would then continue to migrate until the pore volume equal to the specific retention of the underlying unsaturated shale had been filled. At this point, further gravity drainage would cease. The results of the evaluation indicated that the seepage would migrate no more than an additional 0.07 feet.

In summary, the distance seepage is predicted to migrate beneath the sump during the seven years of mining operations is up to 0.07 feet, plus up to an additional 0.07 feet due to gravity drainage after mining operations

cease for a total maximum migration distance of less than 1.0 foot. If inflow to the mine were to remain constant after mining operations cease, the seepage could continue to migrate below the sump and mine. However, using the most realistic estimate of permeability of 10^{-11}cm/sec, the rate of migration is estimated to be 2×10^{-4} feet per year. Therefore, the seepage front would reach the Redwall-Muav aquifer in approximately eight million years. Even using the overly conservative permeability of 10^{-8} cm/sec, the seepage front would not reach the Redwall-Mauv aquifer for at least eight thousand years.

TABLE 3

SUMMARY OF PHYSICAL PROPERTIES OF SAMPLES FROM
BRECCIA PIPE AND HERMIT SHALE

SAMPLE LOCATION	BORING 023 BRECCIA/1389'	BORING 023 BRECCIA/1389'	HER-CH-001 HERMIT/1000'	HER-CH-001 HERMIT/1000'
SAMPLE ORIENTATION	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL
TEST METHOD				
PERMEABILITY TO AIR (md)	0.08	0.02	<0.01	<0.01
PERMEABILITY TO AIR (cm/s) (1)	8.0E-08	2.0E-08	<1.0E-08	<1.0E-08
POROSITY (%)	8.9	8.1	5.6	5.4
PERMEABILITY (md) (2)	(3)	(3)	0.00021	(4)
PERMEABILITY (cm/s) (1,2)	(3)	(3)	2.0E-10	-
(DETERMINED BY KLINKENBERG ANALYSIS)				
WATER CONTENT BY WEIGHT (%)	1	-	1	-
WATER CONTENT BY VOLUME (%)	2.6		2.6	
(DETERMINED BY THERMOGRAVIMETRIC ANALYSIS)				

(1) Conversion from milidarcies to cm/s, 1 md = 9.66E-07 cm/s.
(2) Tested using equivalent overburden pressure of 1000 psi.
(3) Sample disintegrated when tested.
(4) Permeability below detection limit of equipment.

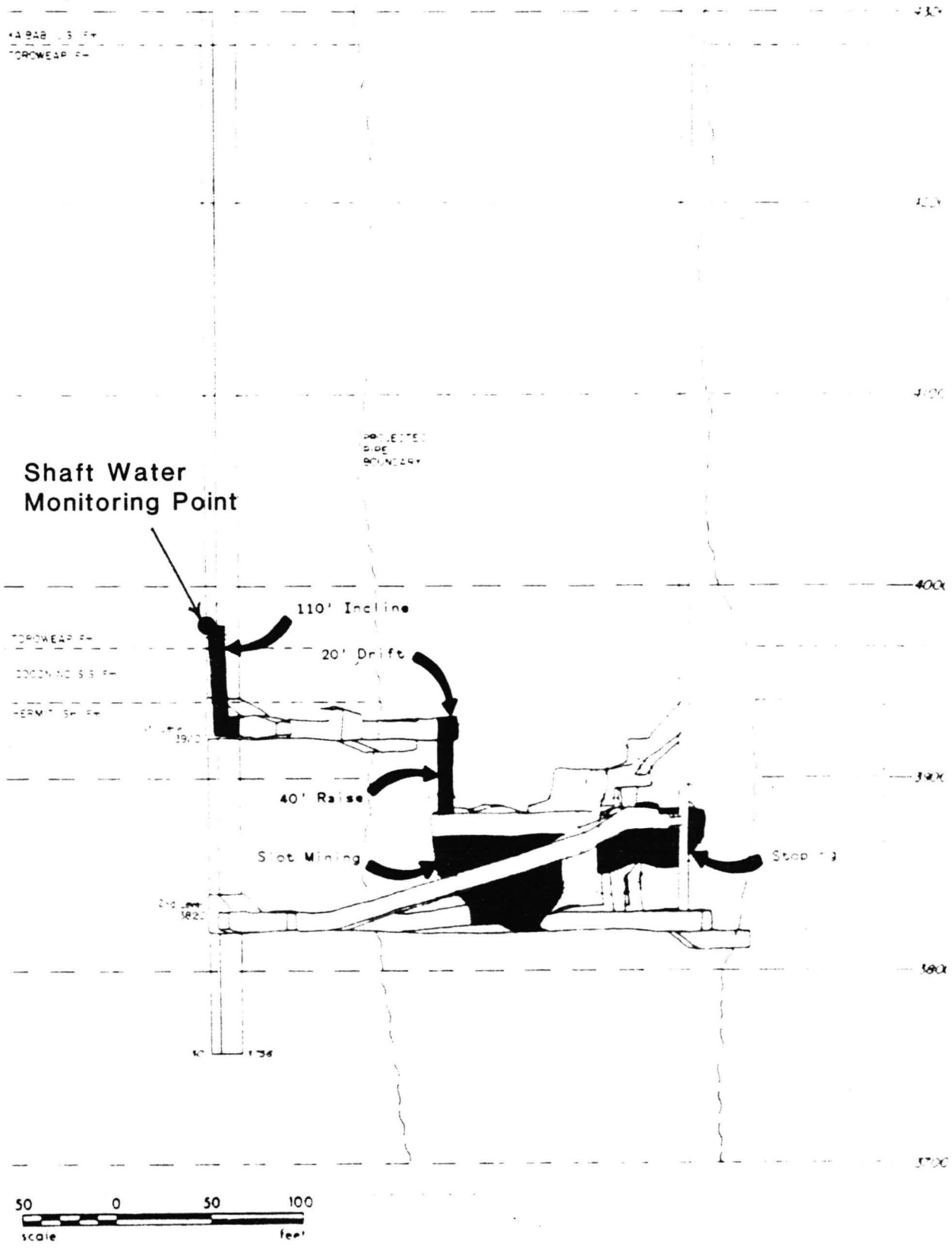


Plate #1

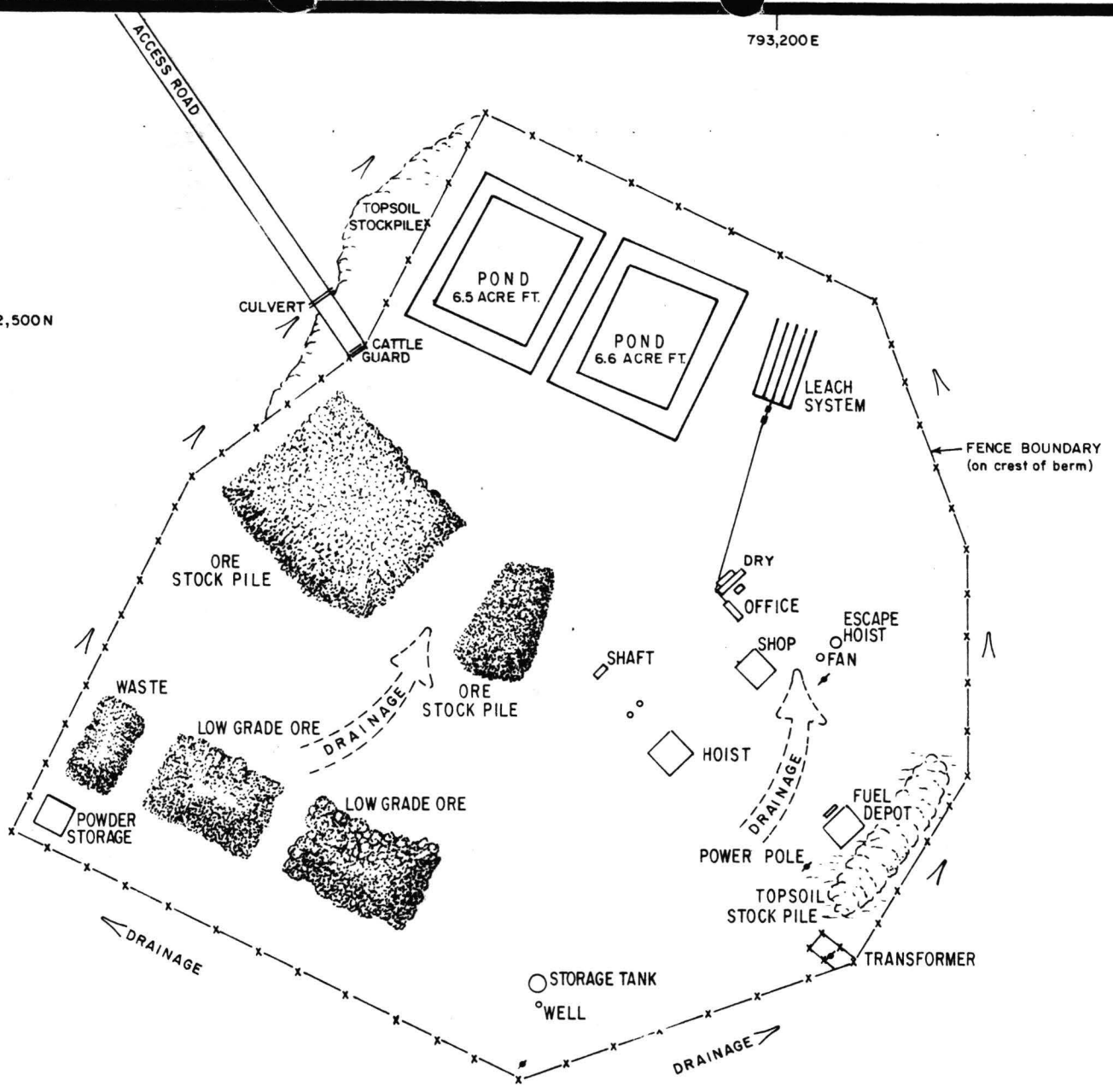
energy fuels nuclear, inc.

PROJECT

TITLE HERMIT SHAFT WATER MONITOR POINTS (3976'MSL)

SCALE | DWG. NO. | REV 2/90

120786



energy fuels nuclear, inc.

Project: HERMIT

REVISION		County: HOHAVE	State: ARIZONA
Date	By	Location: T. N , R W	
		Title: HERMIT SURFACE LAYOUT	
		Scale: 1" = 200'	Date: 9-8-89
		Author: D. PILLMORE	Draftsman: J D M
			Map No.

Plate #2

DRAFT
FOR ~~DISCUSSION PURPOSES ONLY~~

DATE: February 5, 1990

CALL TO: Rich Munson OF: Energy Fuels Nuclear

PHONE NUMBER: 1-303-623-8317

CALL FROM: Jeanmarie Haney OF: DEQ Hydrology

PHONE NUMBER: 257-2117

REGARDING: Check Sampling at Hermit and Pinenut Mines

SUMMARY OF DISCUSSION

I called Mr. Munson to determine when they would be collecting samples for the first quarter of 1990, as required by their permit. He said that they will be sampling next week at both mines.

Hermit
- Well
- Mine sump - discharge pipe into pond at surface
- Mine inflow - difficult sample to collect - hang on chain from hoist

Pinenut
- Well
- They are in the pre-mining phase, so their is no inflow or mine sump sampling

I indicated that, given the probable road conditions at this time of year, I would rather collect split samples during their May sampling. He said that Hermit may be out of production by then, but they would be sampling at least the well and mine inflow at Hermit, and the well at Pinenut. I told him that I would let him know whether I would be coming in February or May.

I decided to go in May

TO Julie Major
Water Pollution Control
Compliance

FROM Abby Myers

SUBJECT Hermit Mine Closure

DATE 7/17/90

MESSAGE

Attached are data from Energy Fuels Pine Nut, Canyon & Portal Hermit Mines. Please note that MCLs are exceeded at the Hermit mine. I have sent the data to Hydrology.

SIGNED

REPLY

Send to AG

SIGNED

DATE / /

REDIFORM 4S 472

SEND PARTS 1 AND 3 INTACT -
PART 3 WILL BE RETURNED WITH REPLY.

POLY PAK (50 SETS)

DETACH AND FILE FOR FOLLOW-UP

TO Jem DuBois / Jeanmarie Hydro Tech

FROM Abby Myers

SUBJECT Hermit Mine Closure DATE 7/17/90

MESSAGE Post Closure data submitted ~~Dated~~ by ~~EF~~ Energy Fuels shows MGL exceedences (attached). They have also provided a discussion of what they will do. Please review & comment. (Jeanmarie was working on this.)

SIGNED

REPLY

and OK compliance.

Exceedances don't seem serious

SIGNED DATE / /

REDIFORM 4S 472 SEND PARTS 1 AND 3 INTACT - PART 3 WILL BE RETURNED WITH REPLY. POLY PAK (50 SETS) 4P472

DETACH AND FILE FOR FOLLOW-UP

Forms 4.5 (Runform) - [wcdb100]

Action Edit Block Field Record Query Window Help

Exit

redi-letter mi File carbonless 89195 TRIP

TO Jeni DuBois/Jeanmarie Haney Hydrologist

FROM Abby Myers

SUBJECT Hermit Mine Closure DATE 7/17/98

MESSAGE Post Closure data submitted ~~Dated~~ by ~~the~~ Energy Fuels show MCL exceedences (attached). They have also provided a discussion of what they will do. Please review & comment. (Jeanmarie was working on this)

SIGNED

REPLY and cc: compliance.

SIGNED DATE / /

REDIFORM 4S 472 SEND PARTS 1 AND 3 INTACT - PART 3 WILL BE RETURNED WITH REPLY. POLY PAK (50 SETS) 4P472

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561
fax 303-595-0930



July 3, 1990

Compliance and Enforcement Branch
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine Groundwater Protection Permit #60035-08

To Whom It May Concern:

Enclosed please find the First and Second Quarter, 1990 analytical results associated with groundwater monitoring at the Hermit Mine. Mining was discontinued in the Hermit Mine on January 31, 1990. Mine closure has proceeded according to actions outlined in the Closure Plan submitted to the Arizona Department of Environmental Quality (ADEQ).

Pursuant to provisions of Section 2.C, Contingency Requirements continued within the Groundwater Protection Permit, Energy Fuels Nuclear hereby notifies the ADEQ of exceedance of some Maximum Groundwater Limits for First and/or Second Quarter samples taken from the Hermit Mine Production/Monitor well (details are contained within the attached Report).

Actions to be taken for investigation of the causes of these exceedances are outlined in the Hermit Groundwater Monitoring Report, Mining Phase, submitted to ADEQ on February 13, 1990.

If you have further questions concerning this matter, please contact me at our Denver office.

Sincerely,

William J. Almas
Environmental Coordinator

WJA/pll
Enclosure

GWPP issued

Hermit closure

Sample collection Points:

- Supply well
- Water inflow point 908 ft below shaft collar
- Mine sump

Compare → How do mine inflow pt and sump samples compare to well samples? Have

Inflow pt

HR023

HR033

HER 042 2nd Q 1989

Date collected 5/31/89

What is HER041 and PW040?

↑ Hermit well ↑ Pinenut well

Premining 4/89 → 5/89

Mining 6/89 → 2/90

sample date	well	shaft Inflow
(6/29/89)	HER 044 2nd Q 1989	HER 045
	HER 048 3rd Q 1989	HER 050
(10/19/89)	HER 051 10/19/89 - confirmation sample	
	HER052 4th Q 1989	

Sump

HER 043

HER 049

Hermit → Two Review Considerations

1) Is closure plan acceptable?

Does it eliminate discharge to Redwall/Muav?

Does it return perched aq to pre-mining condition

2) Exceedance of ALs + MCLs → necessary action?

→ Need K of fill that they will be using in Coconino.

→ Any other water producing (even dribbling) zones?

Hermit

2/12/90 15-20 gpm water flowing from Toroweap one zone, down incline, & into production shaft

1. Talk to engineer about Table I + II in 4/2/90 letter
   "max dry density"? at "req'd" moisture
   "Initial dry density"
   "Initial % compaction"

→ Need 4th Quarter, 1989 GW Mon well results HER 052

3. Look at what permit specifies re: closure.

call Rich Munson - status of closure?

Art Bear - PC solubilities
Water Res Res #67

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

H-100299

HU91-068
November 14, 1991

TO: Abby Myers, Supervisor
Water Permits Unit

THRU: Lauren Evans P.G., Supervisor
State Programs Hydrology Unit

FROM: Jim DuBois, Hydrologist
State Programs Hydrology Unit

RE: Hermit Mine GWQPP #G0035-08

As you requested, I have reviewed a report titled "Water Quality Data Evaluation, Hermit Mine Site" prepared by Canonie Environmental Corp. in June, 1991, as well as a transmittal letter from Energy Fuels Nuclear, Inc. (EFN). These documents have been submitted to ADEQ as part of EFN's contingency measures invoked because of MGL violations at the monitor well at the Hermit Mine Site.

I conclude from the data presented that the facility has not caused or contributed to exceedence of numeric Aquifer Water Quality Standards (AWQS) at the point of compliance. The metals for which where are Federal Primary MCLs as well as barium, fluoride, and nitrate are all well within the limits specified for Arizona aquifers. While gross alpha concentrations are high in the samples taken, none of then exceed the permit MGL, which I presume was set based upon ambient groundwater concentrations. The results for gross alpha are not easily interpreted because they do not subtract out the contribution from uranium and radon. Subtracting the effect of these constituents might even bring the measured values within numeric Aquifer Water Quality Standards. Also, the QA/QC tests conducted indicate that the Barringer lab being used does not produce good consistency. The permittee should consider using a different lab.

The results for gross beta are variable and may indicate a health concern for consumption of the water, but the standard for a discharging facility is based upon only those man-made constituents contributing to gross beta - an impossibility at this site where only mining of naturally occurring ore has taken place. For Radium 226, only two non-consecutive measurements show exceedence with subsequent samplings indicating compliance. Radium 228 has not been analyzed, but should be analyzed in future tests.

It is difficult to say from the data collected whether or not the post-mining monitoring shows that discharge is occurring from the facility. I presume from the strict MGLs set and from the fact that MGLs were established for a much broader range of constituents than primary MCLs, that the intent of the monitoring scheme was to detect the occurrence of any form of discharge. Canonie's argument that the chemical signature based upon radionuclide, nitrate, and arsenic concentration of the mine sump water does not match that of groundwater is persuasive. Nitrate should be a particularly good indicator in this setting, and the groundwater does not show a trace of nitrate in the last nine rounds of sampling. If there has been a discharge, it is not from the mine sump fluids.

Where was the water sampled from?

How is nitrate in mine's water (not a mill) a good indicator?

Most of the indicators selected for monitoring for discharge in the permit are not very useful. I think that the exceedences of MGLs for constituents like EC, alkalinity, bicarbonate, chloride, calcium, magnesium, sodium, iron, manganese, and uranium, at levels slightly above the specified MGL simply show that the ambient concentrations of these constituents were not adequately defined before permitting the facility. I recommend no compliance action for these constituents at this time.

I agree with Canonie's conclusions that sediment in the well water and inadequate purge volumes may be the cause of some of these exceedences. The permit should be modified to require sampling methods consistent with ADEQ's QAPP, i.e., filtered samples for indicator parameters stabilized prior to sampling. Reanalysis of any parameter indicating an exceedence is a standard permit contingency requirement that should be incorporated into this GWQPP.

I disagree with Canonie's recommendation to exclude gross alpha from the monitored constituents. Our Aquifer Water Quality Standards are set based upon this analysis, and if they switch to a better lab, they should not have a problem with the QA/QC of the results.

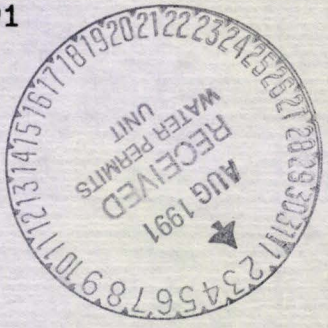
JD:hm
a:hermit.mem#jd1

cc: Julie Major, Water Pollution Compliance Unit

energy fuels nuclear, inc.

p.o. box 36 • fredonia, arizona 86022

July 31, 1991



CERTIFIED MAIL

Mr. Roger W. Kennett
Environmental Program Supervisor
Water Permits Unit
Arizona Department of Environmental Quality
Central Palm Plaza Building
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Request for Modification of the Hermit Mine Groundwater Protection Permit #G-0035-08

Dear Mr. Kennett:

Energy Fuel Nuclear, Inc (EFNI) requests a modification of the Hermit Mine Groundwater Protection Permit #G-0035-08. EFNI proposes elimination of the gross alpha and gross beta constituents which have been previously monitored under the permit. In a cover letter, dated June 7, 1991, addressed to Ms. Julie Major, with the Compliance and Enforcement Branch of ADEQ, titled "Hermit Mine Groundwater Protection Permit #G-0035-08, Evaluation of Exceedances of Maximum Groundwater Limits", which accompanied a report titled "Water Quality Data Evaluation", prepared for EFNI by Canonie Environmental Services Corp., EFNI advised ADEQ of their intention to discontinue monitoring gross alpha and gross beta constituents. The rational for discontinuing the monitoring for gross alpha and gross beta constituents is supported in the above referenced documents enclosed herewith.

EFNI would appreciate a response to the request for modification, prior to the due date for the third quarter monitoring reports. If you have any questions regarding this matter, please contact Roger B. Smith or me at Energy Fuels Fredonia office (602)643-7321.

Sincerely,

Donn M. Pillmore

Donn M. Pillmore
Environmental Coordinator/
Chief Geologist

Enclosures

xc: R. A. Munson
R. B. Smith
M. D. Vincelette

redi-letter MCP® 219725 TRIP

TO Jim Dubois
Hydrology

JUL 3 0 1991

FROM Abby Myers
Water Permits

SUBJECT Hermit Mine DATE 7/29/91

MESSAGE Attached pls find report re: exceedences of MCLs & their explanations. Please review and comment. Also, please consider their gross α & β discussion for possible application to others (ie. new EFN permit application). I'm giving you the only copy - if you want to keep it, pls

SIGNED

REPLY copy, if not, return with your comments.

→ and possible permit modification, and possible relevance to Sage.
esp. discuss 1. sampling method suggestion
2. elimination of gross α & β
3. validity of their argument

SIGNED DATE / /

REDIFORM 4S 472 SEND PARTS 1 AND 3 INTACT - PART 3 WILL BE RETURNED WITH REPLY. carbonless POLY PAK (50 SETS) 4P472

Arizona Department of Environmental Quality

Date 6/14/91

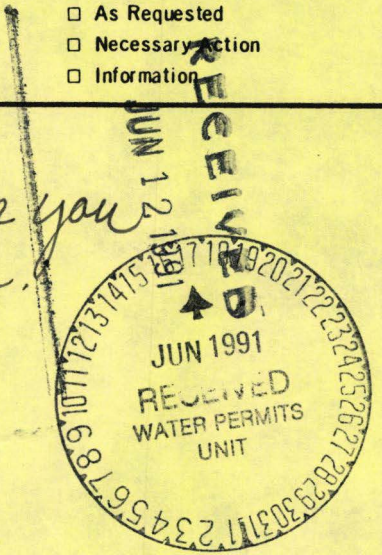
TO Ashley Meyers Rm 202

FROM Julie Major - Rm 305

☐ Review	☐ Per Conversation
☐ Note and see me	☐ As Requested
☐ Note and Return	☐ Necessary Action
☐ Comment	☐ Information

REMARKS:

This is for you
& think.



energy fuels nuclear, inc.
p.o. box 36 • fredonia, arizona 86022

June 7, 1991

Ms. Julie Major
Compliance and Enforcement Branch
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine Groundwater Protection Permit #GO035-08, Evaluation of Exceedances of Maximum Groundwater Limits

Dear Ms. Major:

Enclosed please find the Canonie Environmental Services Corp. (Canonie) report, "Water Quality Data Evaluation, Hermit Mine Site". The Canonie report summarizes water quality data evaluation following action taken to investigate the possible causes of exceedances of Maximum Groundwater Limits (MGLs) at the Hermit Mine as reported July 3, 1990, to ADEQ. The actions taken to address MGL exceedances are outlined in the Energy Fuels Nuclear, Inc (EFNI) report, "Hermit Mine Groundwater Monitoring Report, Mining Phase", submitted February 13, 1990 to ADEQ.

The water quality data evaluation was conducted by Canonie, in order to identify potential causes of MGL exceedances for water samples collected from the Hermit Mine site monitoring well. The focus of the evaluation was to identify factors such as sample collection procedures or analytical error that could cause the exceedances. In addition, the MGLs were evaluated to determine their appropriateness for the radionuclide analytes.

The Canonie report concludes that exceedances in the well were not caused by seepage from the mine. The report also concludes that sediment in the well water and insufficient purge volume prior to sample collection from the well are the main causes of MGL exceedances. Analytical accuracy and precision are not an important factor causing the exceedances in water quality.

Another important determination of the Canonie report found some of the water quality MGL standards are inappropriately applied to the radionuclides. The report finds that continued monitoring of the gross alpha and gross beta activities is unnecessary because the radionuclides, from which they originate, are already being monitored each quarter when the water samples are sent to the lab for analysis. In addition, a standard

applied to gross beta is inappropriate since no man-made radionuclides were used on-site. Also, the Canonie report identified a problem, the current MGLs do not take into effect the counting error, nor does collected data compared to the MGL include the counting error.

Based on the Canonie report, EFNI elects to discontinue monthly, voluntary water sampling, and resume a quarterly sampling as outlined in the Hermit Mine Groundwater Protection Permit #GO035-08. Energy Fuels will resume quarterly sampling during the second quarter, 1991. The quarterly sampling procedure will follow recommendations as outlined on page 33 of the Canonie report.

Energy Fuels also intends to eliminate gross alpha and gross beta from the list of constituents monitored under the Permit. According to the National Interim Primary Drinking Water regulations Part 141.15(a) and Part 141.15(b), gross alpha and gross beta activities are included in water quality analyses to screen for the presence of alpha- and beta-emitting radionuclides. Once screening identifies the presence of the radionuclides, then gross alpha and gross beta analyses can be eliminated and only alpha- and beta-emitting radionuclides are monitored. Further more, a standard is normally applied to gross beta only if man-made radionuclides such as strontium or tritium are present. Since no man-made radionuclides are present at the Hermit Mine, the application of a gross beta standard is not appropriate.

Gross alpha and gross beta activities can be calculated from the radionuclide analytical results and, therefore, will be monitored by monitoring the radionuclides. Since the activity levels are determined by the concentration of radionuclides in water, monitoring and establishing standards for the cause (radionuclide concentrations) rather than the effect (gross alpha and gross beta activities) provides a more accurate assessment of the quality of water.

Also, revision of radionuclide MGLs is recommended to account for the counting error. Rather than assigning a single value to the MGLs, the MGLs should be reported as a range that includes the mean of the counting error plus two standard deviations. A method which could be used to revise these MGLs is outlined on page 27, Part 2.4.2 of the Canonie report. Using that procedure, the recommended radionuclide MGLs are listed as follows:

Analyte	MGL
Gross alpha	57.6 - 110.2 pCi/l
Thorium-230	0.2 - 1.8 pCi/l
Radium-226	3.5 - 5.2 pCi/l

Energy Fuels would appreciate a response from ADEQ concerning the conclusions and recommendations of the Canonie report, and on the proposed action described herein. Should additional questions concerning the Canonie report or Energy Fuels proposed action arise, please contact me at our field office, located in Fredonia, Arizona (602) 643-7321.

Sincerely,

Donn M. Pillmore
Chief Geologist/
Environmental Coordinator

xc: W. J. Almas
L. L. Casebolt
R. A. Munson
R. B. Smith
M. D. Vincelette

energy fuels nuclear, inc.
p.o. box 36 • fredonia, arizona 86022

HAND DELIVERED
To Julie Major
JUNE 11, 1991

June 7, 1991

Ms. Julie Major
Compliance and Enforcement Branch
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Hermit Mine Groundwater Protection Permit #GO035-08, Evaluation of Exceedances of Maximum Groundwater Limits

Dear Ms. Major:

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Energy Fuels would appreciate a response from ADEQ concerning the conclusions and recommendations of the Canonie report, and on the proposed action described herein. Should additional questions concerning the Canonie report or Energy Fuels proposed action arise, please contact me at our field office, located in Fredonia, Arizona (602) 643-7321.

Sincerely,

Donn M. Pillmore

Donn M. Pillmore
Chief Geologist/
Environmental Coordinator

xc: W. J. Almas
L. L. Casebolt
R. A. Munson
R. B. Smith
M. D. Vincelette

Oct 16, 1992

Mr. Roger B. Smith
Manager of Uranium Mine Operations
Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, Arizona 86022

Re: Modification to Groundwater Quality Protection Permit No. G-00 35-08, Hermit Mine

Dear Mr. Smith:

The APCD Mining APP Unit has ~~received~~ reviewed your letter of May 13, 1992 regarding the requested minor modifications to the above-referenced permit. Based on that review, the Department has incorporated the following minor modifications to permit No. G-0035-08 (see attached sheets):

1) Radium-228 ~~is to be~~ has been added to the list of quarterly monitoring parameters;
2) Uranium and ~~radon~~ ~~is to be~~ have been added to the list as a contingency if gross alpha particle activity exceeds 15 pCi/l;
3) Sample collection procedures shall be ~~conducted~~ consistent with item no. 3 of my letter of April 9, 1992;
4) Gross beta particle activity ~~has~~ monitoring has been reduced to annual; and
5) Confirmation sampling of any parameters exceeding the permit maximum groundwater limits (MCLs) has been included

energy fuels nuclear, inc.
p.o. box 36 | ● | fredonia, arizona 86022



May 13, 1992

CERTIFIED MAIL
Certification No: P 988 611 544

Mr. Ed Pond
Mining APP Unit
Arizona Dept. of Environmental Quality
P. O. Box 600
Phoenix, Arizona 85001-0600

Dear Mr. Pond:

Re: Modification to Groundwater Quality Protection Permit #6-0035-08; Hermit Mine

Energy Fuels Nuclear, Inc. (EFNI), has received your letter of April 9, 1992 addressing EFNI's request for a modification to the Hermit Mine Groundwater Quality Protection Permit #6-0035-08. In accordance with your letter and previous correspondence including the report "Water Quality Data Evaluation, Hermit Mine Site" prepared for EFNI by Canonie Environmental, EFNI requests the following minor modifications be made to the Hermit Groundwater Quality Protection Permit:

- Monitoring for Radium 228 will be performed on a quarterly basis. No compliance limits will be associated with this parameter.

- Natural uranium will be monitored in follow-up compliance samples to learn if an exceedance of 15 Ci/1 gross alpha is detected in quarterly samples. Radon concentrate (Ra-222) will be calculated and reported based on Ra 226 concentrations.

- Sample collection procedures will include the purging of a minimum of 3 bore hole volumes prior to acquisition of the grab sample. The parameters pH, EC and temperature will be monitored during the purging process. These parameters will have stabilized to within 10% variation over 3 measurements prior to sample acquisition.

Not always within 24 hours, sometimes took weeks

- Unfiltered, unpreserved samples which have been iced and shipped to the laboratory within 24 hours of collection will be analyzed for total recoverable metals as specified in Methods for Chemical Analysis of Water and Wastes, EPA 60014-79-020.

- Analysis of groundwater samples for gross beta will be performed on an annual basis rather than quarterly. Results from gross beta will be used as a general indicator of groundwater quality and will have no regulatory significance.

- If analytical results indicate an exceedance of alert levels or maximum groundwater limits for any listed parameter, a confirmation sample will be taken and analyzed for the set of parameters contained in Part II, B, Z, b of the Groundwater Protection Permit within 30 days of the receipt of the quarterly sample results.

If you have any questions concerning the request modifications or need additional information, please contact me at our Fredonia office.

Very truly yours,

Roger B. Smith

RBS/ksc

cc: Mr. W. J. Almas
Mr. B. Hamilton
Mr. M. D. Vincelette

Herman Mi

1) Check decay series for: are there significant beta emitters?

Uranium - yes K-40 - yes

Radium - yes Rb-87 - yes

Thorium - yes

2) Check out test methods for:

Gross Alpha {EPA Method 900.1 / Stand. Method 703} Uranium (total, dissolved, 238, 234, 235)

Gross Beta Thorium (230, 232)

Radium 226-228 (Ra-226 - SM-706, EPA-903.1)(Ra228 - SM 707, EPA 904)

Radon

3) Discuss Gross Beta issue with Jim DuBois - should we omit Gross Beta - there are natural sources, including Uranium daughter products and Potassium-40.

4) AAC R18-11-406.C.1. - Max. conc. for gross alpha particle activity, including Ra 226 but excluding Radon & Uranium is 15 pCi/l.

AAC R18-11-406.C.2. - Max conc for combined Radium 226 and Radium 228 shall not exceed [redacted] 5 pCi/l.

The referenced methods for these tests as presented in AAC R18-11-401 through 408 and as specified by AAC R18-11-403.A. and B. are:

	EPA Method	Standard Method
Gross Alpha	900.1	703
Radium 226	903.1	706
Radium 228	904	707

Variance from these methods cannot be allowed for samples analyzed to demonstrate compliance with permit conditions or standards.

1) facility has not caused or contributed to violation of AWQS

2) Need to monitor for Radium-228, Radon, Uranium to determine if AWQS for radiochemicals have occurred.

3) Permit modification request

drop gross alpha – no

drop gross beta – maybe

– we need to add Radium 228, Radon, Dissolved Uranium?

– modify sampling procedures to include 3 well purgings and pH, EC + Temp monitoring (Check to see if these modifications fit within the realm of a minor modification). Sampling procedure should be consistent with QAPP.

– modify permit to require reanalysis of any parameter that exceeds a permit limit as a contingency

– Jim says dissolved (filtered) samples

One rationale for total metals is that if metals (pollutant) in the aquifer do attach to particles that are transmitted to the well bore ~~with samples~~, then we should look at totals in the cases where small drinking water systems and private wells that have no treatment or filtration are impacted or potentially impacted. If the well construction causes heavy loading of particulate matter, and that causes metal concentrations cases where the metals attached to particles to be higher, should we not consider ~~the [illegible]~~ that were not present previously, even though the wells still had a high particulate loading, and thus the ultimate source of the metals was from an upgradient source, whether or not they be dissolved or attached to the surfaces of other minerals (particulates). If the metals are being transported to the well bore, whether ~~they~~ they be

in solution or attached to particles, ~~that, [illegible]~~ we must consider total metals concentrations, because that is what the (well / USers) public would be consuming.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIFE SYMINGTON, GOVERNOR
EDWARD Z. FOX, DIRECTOR

April 9, 1992

Mr. Donn M. Pillmore
Chief Geologist/Environmental Coordinator
Energy Fuels Nuclear
P.O. Box 36
Fredonia, Arizona 86022

RE: Requested modification to Groundwater Quality Protection Permit No. G-0035-08 (Hermit Mine)

Dear Mr. Pillmore:

The Mining APP Unit of the Arizona Department of Environmental Quality has reviewed the request for modification to the above-referenced permit. Energy Fuels Nuclear has requested to drop the requirement to monitor groundwater samples for gross alpha and gross beta particle activity, in accordance with the conclusions from the Canonie Environmental Corporation report titled "Water Quality Data Evaluation, Hermit Mine Site".

This office does agree with some of the points of the Canonie report, mainly that seepage from the mine sump is not the cause of exceedances of permit MGLs. This office will not recommend any further compliance action with respect to the exceedances at this time.

The Mining APP Unit does not agree with the recommendation to exclude gross alpha from the list of monitoring parameters. Current Arizona Aquifer Water Quality Standards (AWQS) are set based upon the analysis for gross alpha particle activity, using EPA method 900.1, in accordance with Arizona Administrative Code (A.A.C.) R18-11-406.C. and A.A.C. R18-11-403.B. The QA/QC tests conducted by Canonie Environmental indicate that the Barringer Lab currently being used does not produce good consistency. This office recommends switching to a lab that can produce more accurate and consistent results.

The Department further recommends the GWQPP No. G-0035-08 be modified to include the following:

1) monitoring for Radium 228;

2) monitoring for Radon and Uranium if gross alpha activity exceeds 15 pCi/l;

3) modification of sample collection procedures to purge at a minimum 3 bore volumes of water and monitor pH, EC and temperature until these parameters have stabilized with no more than a 10% variation. The greater volume of the two should be purged.

The Canonie report also concludes that sediment in the well water may be contributing to MGL exceedances. Monitoring for the purposes of demonstrating compliance with Aquifer Water Quality Standards or permit limits requires that metals analyses be for total recoverable metals. The Mining APP Unit recommends that future samples be for total recoverable metals. Total metals analyses (i.e., total digestion) may result in values that are not representative of the aquifer since the totals analysis involves a complete digestion of any suspended particles. Total recoverable is generally more representative of aquifer conditions as only those metals attached to suspended matter will be "stripped" during the acidification process. Filtered (dissolved) samples may not be representative.

The request to remove gross beta from the list of monitoring parameters states that the standard is based upon only man-made constituents contributing to gross beta. Although this is generally true, the gross beta test detects beta particle activity from both natural and man-made sources. I agree that the use of a gross beta standard may be inapplicable in this situation, however, the test does provide useful data in characterizing the radioactive properties of the groundwater sampled. There are numerous naturally occurring beta-emitters, including Radium-228, Potassium-40, Rudidium-87, Thorium-234, Lead-214, Bismuth-214 and Lead-210, several of which are Uranium-238 daughters. This office would be willing to reduce the monitoring frequency of gross beta from quarterly to annually. Additionally, future results that exceed the permit MGL or AWQS for gross beta will not be viewed as an exceedance of the primary standard based on man-made radio-nuclides. They may be interpreted as violations of narrative AWQS however.

The Department would also like to modify the permit to include a requirement that the permittee re-analyze any parameter that exceeds a permit limit or AWQS, within thirty days of becoming aware of the exceedance, as part of a contingency action.

I would like to point out that <u>only</u> minor modifications to Groundwater Quality Protection Permits (GWQPPs) are permissible. Major modifications to permits require a public notice, and the only vehicle the Department has to conduct major modifications to GWQPPs is by going through the APP process. The following are considered to be minor modifications to GWQPPs, in accordance with the former A.A.C. R9-20-221.B.8.:

1) to correct typographical errors;
2) to require more or less frequent monitoring or reporting by the permittee;
3) to change an interim compliance date in a schedule of compliance;
4) to change construction requirements.

The Department feels that the removal of monitoring requirements falls outside the realm of minor modifications.

Please review the recommendations I have made above, and then contact me at your convenience. I will prepare a modification to your permit, but will await for your response before any formal changes are made.

If you have any questions regarding this matter, feel free to contact me at 257-2270.

Sincerely,

Ed Pond
Mining APP Unit
Plan Review and Permits Section
Office of Water Quality

EP:lg

cc: Julie Major, Water Pollution Compliance Unit
Jim DuBois, Groundwater Monitoring Unit

(1) Discharge Monitoring

On an annual basis the effluent from the septic system shall be sampled and analyzed for those parameters listed in Part II.B.2.b. The sampling point shall be located after the effluent flows from the septic tank and before disposal to the leach trenches.

(2) Impoundment Monitoring

The operator shall inspect the impoundment for mechanical damage, seam failure and maintenance of freeboard on a daily basis.

(3) Groundwater Monitoring

The operator shall monitor the water supply/monitoring well, Department of Water Resources Well Registry No. 55-518877, quarterly for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Static water level in the well shall be measured and recorded prior to sample pumping. If the well is used for production, pumping shall be suspended for 24 hours prior to observing the static water level. The operator shall evacuate at least one bore volume prior to sampling the monitoring well. The amount pumped shall be recorded. The water purged from the well shall be contained in the lined impoundment, stored in impervious containers, or used at the mine site.

Where are the static water levels recorded?

(4) Mine Inflow Monitoring

Mine inflows shall be monitored in the shaft and at the mine sump. Within the shaft, water quality and quantity shall be monitored annually from each geologic unit which continues to produce water for the parameters listed in Part II.B.2.b. Water quality analysis shall not be subject to Maximum Groundwater Limits.

Inflows within the mine shall be monitored at the mine sump for quality by quarterly sampling and analysis for the parameters listed in Part II.B.2.a. and annually for the parameters listed in Part II.B.2.b. Quantity of mine inflows shall be estimated on a quarterly basis taking into account the

consumption of water by underground drilling and dust control, and the return flows from these operations. Any significant inflows shall be depicted on a mine map and submitted to ADEQ as part of the quarterly report.

c. Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

The operator shall continue to monitor the water sampling/monitoring well, Division of Water Resources Well Registry No. 55-51877 semiannually during a minimum period of fifteen (15) years for the parameters in Part II.B.2.b. The Maximum Groundwater Limits shall be those calculated for Phase II (mining) groundwater monitoring.

2. Constituents for Analyses

Two categories of constituents for analysis shall be used while monitoring - indicator parameters with Alert Levels and comprehensive list of parameters with Maximum Groundwater Limits:

a. Indicator Parameters

If laboratory chemical analyses for a water sample would detect concentrations of gross alpha, gross beta, and/or any of the selected trace elements in excess of the alert levels, the source for the water sample would be resampled and analyzed for the comprehensive list of parameters:

PARAMETER	ALERT LEVEL (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Arsenic	Reserved*	1	206.2
Barium	Reserved*	2	208.1
Cadmium	Reserved*	1	213.2
Copper	Reserved*	2	220.1
Iron	Reserved*	2	236.1
Lead	Reserved*	1	239.2
Manganese	Reserved*	2	242.1
Mercury	Reserved*	1	245.1
Nitrate (as N)	Reserved*	3	---
Selenium	Reserved*	1	270.2
Silver	Reserved*	2	272.1
Zinc	Reserved*	2	289.1
	(picocuries per liter)		
Uranium (total)	Reserved*	9,10	---
Gross Alpha	Reserved*	4,13	703
Gross Beta	Reserved*	4,13	703

(1) Standard references are listed on Attachment I to this Permit.

* Reserved - Alert levels shall be established once Phase I - Premining Ambient Groundwater Characterization, has been completed and evaluated by the Department.

b. Comprehensive List of Parameters

The comprehensive list of parameters shall be utilized for all samples during Phase I of sampling and yearly thereafter during Phase II at all sampling sites. This list will also be used in the case that the Alert Levels for indicator parameters are exceeded and a confirmation sample is needed.

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Alkalinity (as carbonate)	Reserved**	4	403
Arsenic	Reserved**	1	206.2
Barium	Reserved**	2	208.1
Bicarbonate	Reserved**	3	305.1
Cadmium	Reserved**	1	213.2
Calcium	Reserved**	2	215.1
Carbonate	Reserved**	4	403

(Cont'd.)

PARAMETER	MAXIMUM GROUND-WATER LIMITS (milligrams per liter)	REF I.D.(1)	METHOD OF ANALYSIS
Chloride	Reserved**	3	325.3
Chromium (total)	Reserved**	1	218.2
Copper	Reserved**	2	220.1
Fluoride	Reserved**	3	340.2
Iron	Reserved**	2	236.1
Lead	Reserved**	1	239.2
Magnesium	Reserved**	2	243.1
Manganese	Reserved**	2	243.1
Mercury	Reserved**	1	245.1
Nitrate (as N)	Reserved**	3	---
Phosphate	Reserved**	4	424
Potassium	Reserved**	2	258.1
Selenium	Reserved**	1	270.2
Silver	Reserved**	2	272.1
Silica	Reserved**	-	---
Sodium	Reserved**	2	273.1
Sulfate	Reserved**	3	375.3
Total Dissolved Solids	Reserved**	3	160.3
Zinc	Reserved**	2	289.1
	(micromhos per centimeter)		
Specific Conductance	Reserved**	3	120.1
	(picocuries per liter)		
Gross Alpha	Reserved**	4,13	703
Gross Beta	Reserved**	4,13	703
Total Uranium	Reserved**	9,10	---
Thorium 230	Reserved**	9,10	---
Radium 226	Reserved**	4,7	705,706

(1)Standard references are listed on Attachment I to this Permit.

** Reserved - Maximum Groundwater Limits shall be based on the ambient concentrations of chemical constituents in groundwater. A statistical analysis of the results of the Phase I monitoring program shall be used to determine the Maximum Groundwater Limits as follows:

(1) If a primary or secondary drinking water standard or Maximum Groundwater Limit has been established for a parameter by Arizona State regulatory agencies, and if the arithmetic mean plus two standard deviations of concentrations of the parameter in groundwater samples obtained during the pre-mining period does not exceed the drinking water standard, the Maximum Groundwater Limit shall be the drinking water standard.

If the arithmetic mean plus two standard deviations of concentrations of the parameter exceeds an established primary or secondary drinking water standard, the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of concentration of the parameter in groundwater samples.

(2) If a primary or secondary drinking water standard has not been established by the regulatory agencies for a parameter and the parameter is detected in groundwater samples during the pre-mining period, or if the arithmetic mean plus two standard deviations of concentrations in groundwater samples obtained during the pre-mining period exceeds the established drinking water standard, then the Maximum Groundwater Limit shall be the arithmetic mean plus two standard deviations of the pre-mining concentrations.

(3) If a parameter is not detected during the pre-mining monitoring period, and a primary or secondary drinking water standard has not been established for the parameter, the Maximum Groundwater Limit shall be twice the detection limit for the EPA laboratory method used.

3. Monitoring Forms

All monitoring results shall be recorded and reported on the Self-Monitoring Form supplied by ADEQ. This form should be given to the laboratory performing the analysis.

4. Reporting

The permittee shall submit a report summarizing progress of the mine development and monitoring results on an annual basis. The report shall contain a current site plan, a map of the underground mine workings including elevations, and shall indicate the locations of all monitoring sites required by this permit. All analytical monitoring results for the previous quarter shall be postmarked no later than

the 28th day of the second month following the completed reporting period as indicated below:

Self-Monitoring Report Forms for	are due by
1st Quarter (Jan, Feb, Mar)	May 28
2nd Quarter (Apr, May, Jun)	Aug 28
3rd Quarter (Jul, Aug, Sep)	Nov 28
4th Quarter (Oct, Nov, Dec)	Feb 28

All laboratory reports shall be submitted to the following location:

Arizona Department of Environmental Quality
OWQ - Water Pollution/UST Compliance Unit
2005 North Central Avenue
Phoenix, Arizona 85004

C. Contingency Requirements

1. Should any of the monitoring results required by this permit exceed the alert level specified for a particular parameter, the permittee shall immediately notify the Department of the apparent exceedance and resample to determine the validity of the sample result.

2. In the event that a confirmed exceedance of the Maximum Groundwater Limit specified in Part II.B.2.b. occurs at the monitoring well, the operator shall submit a report within 60 days which assesses the impacts from the exceedance and the mining operation.

3. In the event that the minimum freeboard requirement specified in Part II.A.1.a. is violated, the permittee shall construct an additional impoundment equivalent in construction to the lined impoundment required by Part II.A.1.a.

4. In the event that any portion of the containment system or the septic system fails, resulting in the violation of permit conditions, the owner/operator shall notify the Department's Water Pollution/UST Compliance Unit and the Mohave County Health Department immediately to determine the appropriate action to mitigate the effects of the violation.

D. Closure/Post Closure

1. The Department shall be notified in writing at least one hundred and eighty (180) days prior to closure or abandonment of the facility. The operator shall submit and have approved an updated Post-closure Plan prior to this time.

Arizona Department of Environmental Quality

Date 1-17-92

To: Lauren Evans, Manager
Permits Hydrology Unit

From:
Water Pollution Compliance Unit

[] Review
[] Note & See Me
[] Note & Return
[] Comment
[] Prepare Draft for:
[] Per Conversation
[] As Requested
[] Necessary Action
[] Information
[] Your Copy
[] Assistant Director's Signature
[] Director's Signature

Remarks:

WPCU/FORM

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

INTER-OFFICE MEMORANDUM

January 17, 1992
Ref: #565

TO: Harley R. Hiett P.E., Manager
Northern Regional Office

THRU: Reza Azizi, Acting Manager RA
Water Pollution Compliance Unit

FROM: Jerry Stout, Compliance Officer JRS
Water Pollution Compliance Unit

RE: Hermit Mine Groundwater Quality Protection Permit (GWQP) #G0035-08, Fredonia, Mohave County

On September 25, 1989 staff from the Northern Regional Office (NRO) of the Arizona Department of Environmental Quality (ADEQ) performed an inspection on the above facility. During this inspection, NRO staff detected no deficiencies in the operation, maintenance, or management of this system. On May 28, 1991, the Water Pollution Compliance Unit (WPCU) notified the facility that they had violated the terms of their GWQP by not submitting a quarterly monitoring report for the first quarter of 1991. On June 14, 1991, the WPCU received a letter from Energy Fuels Nuclear (EFN), asking that the letter of noncompliance be rescinded due to the monitoring report being received by ADEQ before the deadline. In addition, on June 12, 1991, the QWQP was modified to reflect new reporting dates for the facility. On June 14, 1991, the WPCT sent a letter to the facility rescinding the notice of violation of their permit (copy enclosed).

On July 3, 1990, EFN reported that Maximum Groundwater Limits may have been exceeded at Hermit Mine. On November 14, 1991, State Programs Hydrology Unit personnel determined that Aquifer Water Quality Standards has not been exceeded by the facility (copy enclosed).

The facility is now in post-closure per the Mining Aquifer Protection Permit Unit (MAPP). In addition, Roger Kennett, Manager, MAPP, notified personnel of the Water Pollution Compliance Unit via telephone on November 11, 1991, that MAPP will take jurisdiction in this case. Consequently, the WPCU has determined that no further enforcement action will be taken against the facility at this time, pending additional notification from MAPP.

If you have any questions regarding this matter, please call me at (602) 257-2202.

cc: Roger Kennett, Manager, Mining APP Unit
Lauren Evans, Manager, Permits Hydrology Unit

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

L00299

FIFE SYMINGTON, GOVERNOR
RANDOLPH WOOD, P.E., DIRECTOR

REF# 294
June 14, 1991

Mr. Donn M. Pillmore
Energy Fuels Nuclear, Inc.
P. O. Box 36
Fredonia, Arizona 86022

RE: ENERGY FUELS NUCLEAR - HERMIT MINE
100299 380209 G-0035-08

Dear Mr. Pillmore:

In response to your letter of June 11, please disregard our letter from Louis Parsons, dated May 28, 1991. Your reporting is in full compliance with your referenced Permit, as written.

We regret any inconvenience caused.

Should you have further questions or concerns, please write or call me at (602) 257-2210.

Sincerely,

Wayne Hood, Jr.
Water Pollution Compliance Tracking

:wh

cc: Central Regional Office
Mohave County Health Department

-

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

H-100299

HU91-068
November 14, 1991

TO: Abby Myers, Supervisor
Water Permits Unit

THRU: Lauren Evans P.G., Supervisor
State Programs Hydrology Unit

FROM: Jim DuBois, Hydrologist
State Programs Hydrology Unit

RE: Hermit Mine GWQPP #G0035-08

As you requested, I have reviewed a report titled "Water Quality Data Evaluation, Hermit Mine Site" prepared by Canonie Environmental Corp. in June, 1991, as well as a transmittal letter from Energy Fuels Nuclear, Inc. (EFN). These documents have been submitted to ADEQ as part of EFN's contingency measures invoked because of MGL violations at the monitor well at the Hermit Mine Site.

I conclude from the data presented that the facility has not caused or contributed to exceedence of numeric Aquifer Water Quality Standards (AWQS) at the point of compliance. The metals for which where are Federal Primary MCLs as well as barium, fluoride, and nitrate are all well within the limits specified for Arizona aquifers. While gross alpha concentrations are high in the samples taken, none of then exceed the permit MGL, which I presume was set based upon ambient groundwater concentrations. The results for gross alpha are not easily interpreted because they do not subtract out the contribution from uranium and radon. Subtracting the effect of these constituents might even bring the measured values within numeric Aquifer Water Quality Standards. Also, the QA/QC tests conducted indicate that the Barringer lab being used does not produce good consistency. The permittee should consider using a different lab.

The results for gross beta are variable and may indicate a health concern for consumption of the water, but the standard for a discharging facility is based upon only those man-made constituents contributing to gross beta - an impossibility at this site where only mining of naturally occurring ore has taken place. For Radium 226, only two non-consecutive measurements show exceedence with subsequent samplings indicating compliance. Radium 228 has not been analyzed, but should be analyzed in future tests.

The pre-maining samples were collected from boreholes, not the R/M well

It is difficult to say from the data collected whether or not the post-mining monitoring shows that discharge is occurring from the facility. I presume from the strict MGLs set and from the fact that MGLs were established for a much broader range of constituents than primary MCLs, that the intent of the monitoring scheme was to detect the occurrence of any form of discharge. Canonie's argument that the chemical signature based upon radionuclide, nitrate, and arsenic concentration of the mine sump water does not match that of groundwater is persuasive. Nitrate should be a particularly good indicator in this setting, and the groundwater does not show a trace of nitrate in the last nine rounds of sampling. If there has been a discharge, it is not from the mine sump fluids.

Most of the indicators selected for monitoring for discharge in the permit are not very useful. I think that the exceedences of MGLs for constituents like EC, alkalinity, bicarbonate, chloride, calcium, magnesium, sodium, iron, manganese, and uranium, at levels slightly above the specified MGL simply show that the ambient concentrations of these constituents were not adequately defined before permitting the facility. I recommend no compliance action for these constituents at this time.

I agree with Canonie's conclusions that sediment in the well water and inadequate purge volumes may be the cause of some of these exceedences. The permit should be modified to require sampling methods consistent with ADEQ's QAPP, i.e., filtered samples for indicator parameters stabilized prior to sampling. Reanalysis of any parameter indicating an exceedence is a standard permit contingency requirement that should be incorporated into this GWQPP.

I disagree with Canonie's recommendation to exclude gross alpha from the monitored constituents. Our Aquifer Water Quality Standards are set based upon this analysis, and if they switch to a better lab, they should not have a problem with the QA/QC of the results.

JD:hm
a:hermit.mem#jd1

cc: Julie Major, Water Pollution Compliance Unit

MU93:02__ File No. 100299

November 1, 1993

Mr. Roger B. Smith
Manager of Uranium Mine Operations
Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, Arizona 86022

Re: Modification to Groundwater Quality Protection Permit No. G-0035-08, Hermit Mine

Dear Mr. Smith:

The Arizona Department of Environmental Quality Mining APP Unit has reviewed your submittals regarding the modifications to the above referenced permit. Based on that review this office has incorporated the following minor modifications to permit no. G-0035-08 (see attached sheets) :

1. Radium-228 has been added to the list of comprehensive list of monitoring parameters. No alert levels or maximum groundwater limits will be established at this time, although the Department reserves the right to establish permit limits if deemed necessary at some later date;

2. Uranium (total)[1] and radon-222 have been added to the list as a contingency if gross alpha particle activity exceeds 15 picocuries per liter (pCi/L);

3. The gross beta particle activity monitoring has been reduced to an annual monitoring frequency;

4. Sample collection procedures shall be modified to include the purging of a minimum of three well bore volumes from the production/monitor well prior to sampling and the monitoring of pH, conductivity, and temperature during the purging process to insure stabilization of these parameters to within 10% of the previous three measurements prior to sampling. Future samples should not be filtered as proposed, because, according to the Canonie report of June 1991 submitted to this office, all previous samples collected to establish the permit limits and for compliance monitoring purposes were unfiltered samples. All

future analyses should be for total metals, consistent with previous sampling and analysis;

5. Confirmation sampling of any parameter exceeding the maximum groundwater limit or the alert level has been included in PART II.C.1.

In your letter dated July 16, 1993 you requested that all monitoring parameters be reduced to an annual monitoring frequency, an alteration to the original proposal, which was to only reduce the monitoring frequency of the gross alpha and gross beta particle activities. In order to consider your revised proposal, it will be necessary to have an ADEQ hydrologist conduct an analysis of your proposal, which will add significant time to the modification process considering the Department's already over-taxed resources. At this time the Department is willing to proceed with the minor modifications described above. It would be more prudent to concentrate the workload of the Mining APP Unit and Permits Hydrology staff to work on existing and new Aquifer Protection Permits such as the Arizona 1 Mine and the Canyon Mine. Your request to reduce the monitoring frequency of all parameters is denied at this time. If you wish the Department to reconsider the request, a full hydrologic analysis will be required. Please indicate if you wish the Mining APP Unit to reconsider the request. The processing time will likely be lengthy.

The request to change the method of determining the alert levels and maximum groundwater limits can not be accommodated as a minor modification because the method for setting permit limits is specified in the permit, and to change the method would be a major modification to the permit. The only avenue open for making such a modification is through the APP process.

If you have any questions or comments regarding this matter, feel free to contact me at (602) 207-4575. Upon your written concurrence to the proposed modifications this office shall officially modify the permit and notify the ADEQ Water Pollution Compliance Unit of the changes.

Sincerely,

Ed Pond
Environmental Program Specialist
Mining APP Unit
Office of Water Quality

1 Uranium (total) is the sum of the U-234, U-235, and U-238 particle activities.

cc: Water Pollution Compliance Unit

6 pgs

9/29/93

FAX to ED Pond
(602) 207-4645
ARIZONA Department of
ENVIROMENTAL QUALITY

From Roger Smith
Energy Fuels Nuclear Inc.
(602) 643-7328

Ed

The last correspondence
Between EFNI and ADEQ is
Described in these Letters Dated
April 13, 1992 and July 16 1993.
Upon your Review Please Let
me know via FAX (Hand written note)
what your Decision is concerning the
Requested modification of The Hermit
mine water sampling procedures —

Thanks
Roger Smith

P.S. - your comment
concerning the Arizona 1
mine - Permit Is Posted
In my Log Book In Red "

OCT 05 '93 11:50AM ENERGY FUELS NUCLEAR P.1/6

energy fuels nuclear, inc.

2555 N. Hwy 89A
HC 64, Box 152
Fredonia, Arizona 86022

Operations - (602) 643-7321
Fax Number - (602) 643-7328

July 16, 1993

CERTIFIED MAIL NO. P 246 814 799

Mr. Ed Pond
Mining APP Unit
Arizona Department of Environmental Quality
P.O. Box 600
Phoenix, Arizona 85001-0600

Dear Mr. Pond:

Re: Modification to Groundwater Quality Protection Permit #6-0035-08; Hermit Mine

Energy Fuels Nuclear, Inc. (EFNI), has resumed the post mining schedule of monitor well sampling at the Hermit Mine. As per our telephone conversation in May of this year, EFNI formally requests that the Hermit Groundwater Protection Permit be modified to permit post mining water sampling on an annual basis for the comprehensive list of parameters rather than the current semiannual schedule. Changes in monitoring frequency are considered minor modifications and are permissible.

EFNI agrees to add the analyte Ra 228 to the comprehensive list of parameters contained in Part IIb 2 b of the permit with the understanding that no maximum levels (MGL) will be assigned for the analyte.

EFNI has also elected to filter future water samples prior to acidification and submission for total analysis. This decision is supported by the fact that samples used to establish the premining baseline were all filtered prior to analysis.

It is further requested that those radionuclide MGL's which incorporate a counting error, i.e., Ra 226, gross alpha, gross beta, and thorium 230 be reported as a range rather than reporting a single value. The proposed MGL's would be the mean of the counting error, plus two standard deviations.

The recommended radionuclide MGL's are listed as follows:

Analyte	MGL
Gross Alpha	57.6 - 110.2 pci/l
Thorium 230	0.2 - 1.8 pci/l
Radium 226	3.5 - 5.2 pci/l

Verbal approval by telephone or facsimile as soon as possible plus written approval to follow will be greatly appreciated.

Sincerely,

Lawrence L. Casebolt

Lawrence L. Casebolt
Sr. Mine Geologist

LLC/ksc

cc: Mr. Roger B. Smith

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIFE SYMINGTON, GOVERNOR
EDWARD Z. FOX, DIRECTOR

RECEIVED
APR 13

April 9, 1992

Mr. Donn M. Pillmore
Chief Geologist/Environmental Coordinator
Energy Fuels Nuclear
P.O. Box 36
Fredonia, Arizona 86022

RE: Requested modification to Groundwater Quality Protection Permit No. G-0035-08 (Hermit Mine)

Dear Mr. Pillmore:

The Mining APP Unit of the Arizona Department of Environmental Quality has reviewed the request for modification to the above-referenced permit. Energy Fuels Nuclear has requested to drop the requirement to monitor groundwater samples for gross alpha and gross beta particle activity, in accordance with the conclusions from the Canonie Environmental Corporation report titled "Water Quality Data Evaluation, Hermit Mine Site".

This office does agree with some of the points of the Canonie report, mainly that seepage from the mine sump is not the cause of exceedances of permit MGLs. This office will not recommend any further compliance action with respect to the exceedances at this time.

The Mining APP Unit does not agree with the recommendation to exclude gross alpha from the list of monitoring parameters. Current Arizona Aquifer Water Quality Standards (AWQS) are set based upon the analysis for gross alpha particle activity, using EPA method 900.1, in accordance with Arizona Administrative Code (A.A.C.) R18-11-406.C. and A.A.C. R18-11-403.B. The QA/QC tests conducted by Canonie Environmental indicate that the Barringer Lab currently being used does not produce good consistency. This office recommends switching to a lab that can produce more accurate and consistent results.

The Department further recommends the GWQPP No. G-0035-08 be modified to include the following:

1) monitoring for Radium 228;

2) monitoring for Radon and Uranium if gross alpha activity exceeds 15 pCi/l;

OCT 05 '93 11:59AM ENERGY FUELS NUCLEAR

3) modification of sample collection procedures to purge at a minimum 3 bore volumes of water and monitor pH, EC and temperature until these parameters have stabilized with no more than a 10% variation. The greater volume of the two should be purged.

The Canonie report also concludes that sediment in the well water may be contributing to MGL exceedances. Monitoring for the purposes of demonstrating compliance with Aquifer Water Quality Standards or permit limits requires that metals analyses be for total recoverable metals. The Mining APP Unit recommends that future samples be for total recoverable metals. Total metals analyses (i.e., total digestion) may result in values that are not representative of the aquifer since the totals analysis involves a complete digestion of any suspended particles. Total recoverable is generally more representative of aquifer conditions as only those metals attached to suspended matter will be "stripped" during the acidification process. Filtered (dissolved) samples may not be representative.

The request to remove gross beta from the list of monitoring parameters states that the standard is based upon only man-made constituents contributing to gross beta. Although this is generally true, the gross beta test detects beta particle activity from both natural and man-made sources. I agree that the use of a gross beta standard may be inapplicable in this situation, however, the test does provide useful data in characterizing the radioactive properties of the groundwater sampled. There are numerous naturally occurring beta-emitters, including Radium-228, Potassium-40, Rudidium-87, Thorium-234, Lead-214, Bismuth-214 and Lead-210, several of which are Uranium-238 daughters. This office would be willing to reduce the monitoring frequency of gross beta from quarterly to annually. Additionally, future results that exceed the permit MGL or AWQS for gross beta will not be viewed as an exceedance of the primary standard based on man-made radio-nuclides. They may be interpreted as violations of narrative AWQS however.

The Department would also like to modify the permit to include a requirement that the permittee re-analyze any parameter that exceeds a permit limit or AWQS, within thirty days of becoming aware of the exceedance, as part of a contingency action.

I would like to point out that only minor modifications to Groundwater Quality Protection Permits (GWQPPs) are permissible. Major modifications to permits require a public notice, and the only vehicle the Department has to conduct major modifications to GWQPPs is by going through the APP process. The following are considered to be minor modifications to GWQPPs, in accordance with the former A.A.C. R9-20-221.B.8.:

1) to correct typographical errors;
2) to require more or less frequent monitoring or reporting by the permittee;
3) to change an interim compliance date in a schedule of compliance;
4) to change construction requirements.

OCT 05 '93 12:00PM ENERGY FUELS NUCLEAR

The Department feels that the removal of monitoring requirements falls outside the realm of minor modifications.

Please review the recommendations I have made above, and then contact me at your convenience. I will prepare a modification to your permit, but will await for your response before any formal changes are made.

If you have any questions regarding this matter, feel free to contact me at ~~257-2270.~~ 602-207-4575

Sincerely,

Ed Pond
Mining APP Unit
Plan Review and Permits Section
Office of Water Quality

EP:lg

cc: Julie Major, Water Pollution Compliance Unit
Jim DuBois, Groundwater Monitoring Unit

OCT 05 '93 12:02PM ENERGY FUELS NUCLEAR

energy fuels nuclear, inc.

2555 N. Hwy 89A
HC 64, Box 152
Fredonia, Arizona 86022

Exploration - (602) 643-7325
Operations - (602) 643-7321
Fax Number - (602) 643-7328

FACSIMILE TRANSMITTAL

Page 1 of 3

TO: MR. ED POND
ADEQ

FAX NO: 602 207 4674

PHONE NO:

FROM: LARRY CASEBOLT
EFNI

DATE: 8-02-93

IF YOU DO NOT RECEIVE ALL PAGES,

PLEASE CALL LARRY CASEBOLT, TELEPHONE 602 643-7321

AUG 02 '93 11:16AM ENERGY FUELS NUCLEAR P.1/3

energy fuels nuclear, inc.

2555 N. Hwy 89A
HC 64, Box 152
Fredonia, Arizona 86022

Operations - (602) 643-7321
Fax Number - (602) 643-7328

July 16, 1993

CERTIFIED MAIL NO. P 246 814 799

Mr. Ed Pond
Mining APP Unit
Arizona Department of Environmental Quality
P.O. Box 600
Phoenix, Arizona 85001-0600

Dear Mr. Pond:

Re: Modification to Groundwater Quality Protection Permit #6-0035-08; Hermit Mine

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EFNI agrees to add the analyte Ra 228 to the comprehensive list of parameters contained in Part IIb 2 b of the permit with the understanding that no maximum levels (MGL) will be assigned for the analyte.

EFNI has also elected to filter future water samples prior to acidification and submission for total analysis. This decision is supported by the fact that samples used to establish the premining baseline were all filtered prior to analysis.

It is further requested that those radionuclide MGL's which incorporate a counting error, i.e., Ra 226, gross alpha, gross beta, and thorium 230 be reported as a range rather than reporting a single value. The proposed MGL's would be the mean of the counting error, plus two standard deviations.

The recommended radionuclide MGL's are listed as follows:

Analyte	MGL
Gross Alpha	57.6 - 110.2 pci/l
Thorium 230	0.2 - 1.8 pci/l
Radium 226	3.5 - 5.2 pci/l

EPA gross alpha = 20 pCi/L

Verbal approval by telephone or facsimile as soon as possible plus written approval to follow will be greatly appreciated.

Sincerely,

Lawrence L. Casebolt

Lawrence L. Casebolt
Sr. Mine Geologist

LLC/ksc

cc: Mr. Roger B. Smith

AUG 02 '93 11:18AM ENERGY FUELS NUCLEAR

RECEIVED
AUG 2 1993
PLAN/REVIEW

energy fuels nuclear, inc.

2555 N. Hwy 89A
HC 64, Box 152
Fredonia, Arizona 86022

Operations - (602) 643-7321
Fax Number - (602) 643-7328

July 16, 1993

CERTIFIED MAIL NO. P 246 814 799

Mr. Ed Pond
Mining APP Unit
Arizona Department of Environmental Quality
P.O. Box 600
Phoenix, Arizona 85001-0600

Dear Mr. Pond:

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Verbal approval by telephone or facsimile as soon as possible plus written approval to follow will be greatly appreciated.

Sincerely,

Lawrence L. Casebolt

Lawrence L. Casebolt
Sr. Mine Geologist

LLC/ksc

cc: Mr. Roger B. Smith

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION

WATER PERMITS SECTION
3033 North Central Avenue
Phoenix, Arizona 85012

FAX NUMBER (602) 207-4674

DATE: November 9, 1998

TO: Michelle R. Rehmann

FAX NUMBER: (303) 389-4125

PHONE NUMBER: (303) 389-4131

FROM: Craig DeWalt - Aquifer Protection Project Officer

PHONE NUMBER: (602) 207 - 4789

PAGES: Cover Sheet + 1

COMMENTS: General Agenda Outline. Please call if any comments.

IF YOU HAVE ANY PROBLEMS WITH RECEIVING THIS FAX
PLEASE CALL: (602) 207-4675

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ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION

WATER PERMITS SECTION
3033 North Central Avenue
Phoenix, Arizona 85012

FAX NUMBER (602) 207-4674

DATE: November 9, 1998

TO: Mr. Roger Smith

FAX NUMBER: (520) 643-7328

PHONE NUMBER: (520) 643-7321

FROM: Craig DeWalt - Aquifer Protection Project Officer

PHONE NUMBER: (602) 207 - 4789

PAGES: Cover Sheet + 1

COMMENTS: General Agenda Outline Please call if any comments.

IF YOU HAVE ANY PROBLEMS WITH RECEIVING THIS FAX
PLEASE CALL: (602) 207-4675

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MEETING AGENDA

ADEQ-WPS-MU AND INTERNATIONAL URANIUM (USA) CORPORATION
TUESDAY, NOVEMBER 10, 1998

1:00 - 1:10 Introductions and Opening Comments

1:10 - 1:30 Kanab North Mine

IUC Status Update
ADEQ APP Application
General Discussion

1:30 - 1:50 Hermit Mine

IUC Status Update
ADEQ Closure Requirements
General Discussion

1:50 - 2:10 Pinenut Mine

IUC Status Update
ADEQ APP Application Status
General Discussion

2:10 - 2:30 Canyon Mine

IUC Status Update
ADEQ APP Application Status
General Discussion

2:30 - 3:00 Meeting Summary and Wrap Up

Decisions
Action Items
Schedules

11/9/98

Hermit Mine

* Have post-mining monitoring analysis been occurring and if so, have there been any exceedences in AWQS?
* When did mine cease operation? Before 1986?
* Mining depth limit not to exceed 1,500'.
* Results of radiometric survey required by closure plan? Were there any exceedences or remediation required?
* What happened with the holding pond & any sediments?
* What has been done with the well? Ore Pads?
* Please provide a picture of the site.
* Onart demonstration?
* Financial Capability

11/30/98 ~~* Will go forward with APP application~~

10/22/98

Hermit Mine

International Uranium Corporation - #100299

5/3/97 - MU97:0066 - Nothing mentioned about "call in".

* GWQPP #0035-08 - 1988 - Requires restricted disposal of mine water & runoff to a lined impoundment. Requires monitoring sampling well - Division of Water resources well Registry # 55-51877 semiannually for a minimum period of 15 yrs. POST MINING Also mine influx monitoring quarterly Requires submittal of notification 180 days prior to closure.
* NOD
* 9/3/90 - Exceedances in MGL's
* 11/14/91 - No exceedences occurred per ADEQ. ?
* 1/17/92 - ADEQ inspection - no deficiencies.
* 4/9/92 - ADEQ denies mod request for excluding gross alpha from monitoring parameters.
* 7/93 - Request from EFN to analyze annually rather than semi.
* I can't find any monitoring reports in file 6/90 & 6/91

* Currently supposed to be conducting post mining monitoring → He sends it to us - compliance.
* 10/23 review of Plan of Operations - Need a picture of the reclaimed site. - Results of radiometric survey - Were any exceedences found and remediated? How? Request additional survey. What happened with the holding pond & any sediments? What did they do with the well? Review well water results. What happened to the Ore Pads

* Was there any test results from Chem. Northern on the Moenkopi derived soil from closure plan report on shafts?

Provided in 4/2/90 letter →

10/23/98

Hermit Mine

International Uranium Corporation - #100299

* EFN letter of 7/23/87 regarding N.O.D. 86-55 references
Can't find — Evaporation Pond Design - Drawing No. PN-AA8-13 4.8 acre feet.
Can't find — 36 mil, reinforced, ind. grade Hypalon
* 7/23/87 Also provided: Drainage Plan for the Mine 12/85, Site work completed Charles Leaf P.E.
* Native clay materials being dropped down the shaft
4/2/90 900 ft → coefficients of permeability in the 10^{-8} cm/sec
* 4/3/90 ADEQ North Reg. inspection - sanitary survey. Deficiency (major) noted: internal site drainage shall be improved. Visually, it appeared runoff from the mine site would occur in 2 locations during a significant precipitation event.
7/3/90 Exceedences in MGL's notified. - Canonie Report (6/91)
11/14/91 - ADEQ review of Water Quality Data Evaluation Hydrologist J. Dubois concludes the facility has not caused or contributed to exceedence of numeric AWQS at the point of compliance.
1/17/92 - No action will be taken by compliance.
5/92 - EFN requests "minor mods" to GWQPP as discussed in previous correspondence.
7/93 - EFN requests mod again.
11/93 - Draft letter of approval for mods - not sent?
Also does not look like changes were made in GWQPP
Different Mine — * On the 2/12/90 Premining Water Quality Report, a 9-8-89 Hermit Surface Layout map depicts 2 ponds (1-6.5 acre ft. & 1-6.6 acre ft)
* 1/88 On GWQPP, the pond is described as a 12.6 acre foot

HERMIT MINE GROW RESULTS-MINING 21-DEC-89 14:45:17 Pg 1

100299

Hermit

	A	B	C	D	E	F	G
1	PARAMETERS,	PREMINING	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	MAXIMUM
2	UNITS	SAMPLE	STANDARD	HER 044	HER 048	HER 051	ACCEPTABLE
3		MEAN	DEVIATION	08-29-89	09-21-89	10-19-89	VALUE
4							
5	As,mg/l	0.012	0.0060	0.004	0.008	0.022	0.0241
6	Ba,mg/l	0.022	0.0179	0.02	0.02	0.01	0.0578
7	Cd,mg/l	0.005	0.0112	0.005	0	0	0.0274
8	Cu,mg/l	0.022	0.0110	0.02	0	0	0.0439
9	Fe,mg/l	6.98	2.1157	12	11.6	4.71	11.2114
10	Pb,mg/l	0.03	0.0671	0	0	0	0.1642
11	Mn,mg/l	0.106	0.0404	0.23	0.49	0.39	0.1867
12	Hg,mg/l	0.00054	0.0005	0	0	0	0.0016
13	Se,mg/l	0.0152	0.0138	0.02	0.009	0.023	0.0428
14	Ag,mg/l	0.01	0.0100	0	0	0	0.0300
15	Zn,mg/l	0.0678	0.0603	0.077	0	0.043	0.1885
16	U,mg/l	0.0025	0.0003	0.0035	0.0043	0.0064	0.0030 0.030
17	Alk as CaC03,mg/l	157.4	1.6733		150	0	160.7466
18	HC03 as CaC03,mg/l	157.4	1.6733		150	150	160.7466
19	C03,mg/l	0	0.0000			0	0.0000
20	Ca,mg//l	547	36.5718		542	547	620.1437
21	Cl,mg/l	41.2	1.4370		40	39	44.0740
22	Cr,mg/l	0.08	0.0663		0	0.01	0.2127
23	F,mg/l	1.37	0.0815		1.28	1.43	1.5331
24	Mg,mg/l	181.6	8.9331		186	201	199.4662
25	P04,mg/l	0	0.0000		0	0	0.0000
26	K,mg/l	23.28	2.6957		24.2	31.6	28.6715
27	Si02,mg/l	12.42	0.9602		11.5	9.8	14.3404
28	Na,mg/l	74.8	5.4649		76	102	85.7298
29	S04,mg/l	2226	99.3982		2280	2280	2424.7964
30	TDS,mg/l	3456	29.6648		3440	3220	3515.3296
31	N03 as N,mg/l	0.14	0.3130		0	0	0.7661
32	Gross alpha,pCi/l	20.4	31.7616	28	19	78	83.9232
33	Gross beta,pCi/l	33	5.2440	40	41	54	43.4881
34	Th230,pCi/l	0.34	0.3286		0.2	0	0.9973
35	Ra226,pCi/l	1.96	1.2054		3.3	0.8	4.3708
36	Electrical conductivity,	3324	115.4556		3470	3600	3554.9112
37	umhos/cm	0	0.0000				0.0000
38	pH,units	7.5525	0.3500		6.92		6.8525
39	TSS,mg/l	32.25	37.3486				0.0000
40							

TABLE II

Mining Water Quality Results

Telephone Conversation Log

logged 11/3/98 C.D.

By: Craig DeWalt	Date: 10/30/98	Time:	2:00 p.m. & 4:00 p.m.
Name: Michelle Rehmann		Phone:	(303) 389-4131
Of: International Uranium Corporation		Fax:	(303) 389-4125
Re: Mine Status Discussion (Pinenut, Canyon, Hermit & Kanab)			

Record of conversation:

2:00 p.m. Returned her call placed to Tony Bode. She was calling to discuss GWQPP permits as a call had been placed to Vicki Hoffsetz (I presume by T.B. on 10/16/98. She is getting involved with these mines but has not yet had a chance to review files. I gave her a brief synopsis of the need to convert the GWQPP's to APP's. She said she was going to have a conference call with Mr. R. Smith on Monday, 11/2/98 to discuss the situations. She requested I send her any reference information including our Arizona rules to become familiar with the process. A package was prepared but not mailed until 11/3/98.

4:00 p.m. I called Ms. Rehmann back to inform her that I would be FAXing over a copy of a letter from the ADEQ requiring submittal of an APP application for the Kanab mine. I requested she inform Mr. Smith of this as I was unable to reach him. I explained about Arizona LTF effective 1/1/99.

Notes: Could not get FAX of letter to R. Smith or M. Rehmann due to ongoing FAX machine problems until 11/3/98.

Letters also mailed on 11/3/98.

Telephone Conversation Log

Logged C.D. 11/3/98

By: Craig DeWalt | Date: 10/30/98 | Time: 1:00 p.m.

Name: Mr. Roger Smith | Phone: (970) 677-2726

Of: International Uranium Corporation | Fax: (970) 677-2747

Re: Mine Status Discussion (Pinenut, Canyon, Hermit & Kanab)

Record of conversation:

Contacted Mr. Smith as a follow-up to last weeks telephone conversation. He informed me that he had not yet had a chance to review the files for the mines. I informed him that we really needed to get moving on them. He appreciated my enthusiasm but said that past experience with our agency has him skeptical. I let him know that I believed we had a strong possibility of being able to complete these with a minimal amount of new information being needed. He informed me that they wanted to go forward with APP's to operate for Canyon, Pinenut & Kanab. Hermit mine is reclaimed and needs to be closed. He will contact me by mid next week to discuss further. He asked me to FAX him the last letter requesting info for Canyon Mine. The FAX did not go through and he was to be back at his home office on Monday & should be able to retrieve from his file

Notes:

He once again requested that the sampling of the springs associated with Canyon mine be eliminated. I told him that may be possible, but the only way to do it would be through an APP to operate

Telephone Conversation Log

By: Craig DeWalt Date: 10/22/98 Time: 3:15 p.m.

Name: Mr. Roger Smith Phone: (970) 677-2726
(520) 643-7321

Of: International Uranium Corporation (Pinenut, Canyon, Hermit & Kanab) Fax: (970) 677-2747
(520) 643-7328

Re: Mine status - Status of APP applications & GWQPP's

Record of conversation:

Discussed the status of each mine. Not much info was to be had. He needs to get back to his office and review the files. In general, it appears he wants to continue to stay in a "standby" status as none of the mines are operating. I explained that we would like to proceed with either finishing APP's to operate or APP's to close on the Pinenut & Canyon mines. Also to see about closure on Hermit & Kanab. I explained some about the new LTF coming into effect 1/99. He requested some info on that. I told him I'd FAX him the page or two from the ARS. He said he would discuss these issues with "his people" and call me back.

Notes:

Mr. Smith asked if there was a way to eliminate the current pre-mining water monitoring at the Canyon Mine springs and mine. Dangerous helicopter trips and difficulty getting permission from multiple authorities.

	A	B	C	D	E	F	G	H	I
1	PARAMETER,UNIT	HR 012	HR 019	HR 025	HR 032	HER 041	PREMINING	SAMPLE STANDARD	MAXIMUM ACCEPTABLE
2		04-28-88	~~06-29-89~~ 06-29-88	~~09-29-89~~ 09-29-88	12-23-88	05-31-89	SAMPLE MEAN	DEVIATION	VALUE
3	----------								
4	As,mg/l	0.013	0.015	0.02	0.006	0.006	0.012	0.0060	0.0241
5	Ba,mg/l	0.01	0.02	0.04	0.04	0	0.022	0.0179	0.0578
6	Cd,mg/l	0	0.025	0	0	0	0.005	0.0112	0.0274
7	Cu,mg/l	0.01	0.02	0.02	0.04	0.02	0.022	0.0110	0.0439
8	Fe,mg/l	4.03	7.48	6.21	7.33	9.85	6.98	2.1157	11.2114
9	Pb,mg/l	0	0.15	0	0	0	0.03	0.0671	0.1642
10	Mn,mg/l	0.06	0.11	0.09	0.1	0.17	0.106	0.0404	0.1867
11	Hg,mg/l	0.0011	0.0011	0.0003	0	0.0002	0.00054	0.0005	0.0016
12	Se,mg/l	0.009	0	0.037	0.012	0.018	0.0152	0.0138	0.0428
13	Ag,mg/l	0.01	0.02	0.02	0	0	0.01	0.0100	0.0300
14	Zn,mg/l	0	0.118	0.07	0.136	0.015	0.0678	0.0603	0.1885
15	U,mg/l	0.0025	0.0025	0.0022	0.0024	0.0029	0.0025	0.0003	0.0030
16	Alk as CaC03,mg/l	159	155	157	157	159	157.4	1.6733	160.7466
17	HC03 as CaC03	159	155	157	157	159	157.4	1.6733	160.7466
18	C03,mg/l	0	0	0	0	0	0	0.0000	0.0000
19	Ca,mg/l	585	577	494	533	546	547	36.5718	620.1437
20	Cl,mg/l	43	41	42.3	40.1	39.6	41.2	1.4370	44.0740
21	Cr,mg/l	0.1	0.15	0.13	0.01	0.01	0.08	0.0663	0.2127
22	F,mg/l	1.47	1.39	1.32	1.41	1.26	1.37	0.0815	1.5331
23	Mg,mg/l	183	192	169	177	187	181.6	8.9331	199.4662
24	P04,mg/l	0	0	0	0	0	0	0.0000	0.0000
25	K,mg/l	25.3	24.4	19.4	21.6	25.7	23.28	2.6957	28.6715
26	Si02,mg/l	13.6	12.8	11	12.6	12.1	12.42	0.9602	14.3404
27	Na,mg/l	70.1	78.8	69.5	73.6	82	74.8	5.4649	85.7298
28	S04,mg/l	2230	2240	2080	2220	2360	2226	99.3982	2424.7964
29	TDS,mg/l	3500	3450	3430	3430	3470	3456	29.6648	3515.3296
30	N03 as N,mg/l	0.7	0	0	0	0	0.14	0.3130	0.7661
31	Gross alpha, pCi/l	0	0	76	12	14	20.4	31.7616	83.9232
32	Gross beta, pCi/l	31	27	38	30	39	33	5.2440	43.4881
33	Th230, pCi/l	0	0.7	0.4	0.6	0	0.34	0.3286	0.9973
34	Ra226,mg/l	3.5	2.6	0.4	2.1	1.2	1.96	1.2054	4.3708
35	Electrical conductiv	3430	3210	3340	3440	3200	3324	115.4556	3554.9112
36	umhos/cm								0.0000
37	pH,units	8.02		7.2	7.4	7.59	7.5525	0.3500	8.2525
38	TSS,mg/l	18		14	9	88	32.25	37.3486	106.9472

0.030

EXHIBIT #2

Hermit Mine Premining Groundwater Quality

	AL	MCL
Nitrate	~~5.0~~	10.0

Phosphorous (total) is not on GWQPP list is on SMRF

Fluoride		2.4
Arsenic	0.025	0.05
Barium	0.5	1.0
Cadmium	0.005	0.010
Chromium		0.05
Copper	0.5	1.0
Iron	0.15	0.3
Lead	0.025	0.05

~~Nickel~~

Silver	0.025	0.05
Selenium	0.005	0.01
Gross Beta	5.0	50.0
Total Radium 226		
Total Nat. Uranium		Reserved
Mercury	0.001	0.002
Gross Alpha	5.0	15.0
Zinc	5.0	Res.
Thorium 230	~~Res~~	Res

12/31 - ~~When did the mine complete closure activities.~~
- ~~Reclamation activities~~
-
-

1/6 - 1 pond or 2 ponds?
- Condition of liner
- Ore pad disposal

Hermit

MEETING AGENDA

ADEQ-WPS-MU AND INTERNATIONAL URANIUM (USA) CORPORATION
TUESDAY, NOVEMBER 10, 1998

1:00 - 1:10 Introductions and Opening Comments

1:10 - 1:30 Kanab North Mine

IUC Status Update
ADEQ APP Application
General Discussion

1:30 - 1:50 Hermit Mine

IUC Status Update
ADEQ Closure Requirements - Notice - Agency of Governments
General Discussion

1:50 - 2:10 Pinenut Mine

IUC Status Update
ADEQ APP Application Status
General Discussion

2:10 - 2:30 Canyon Mine

IUC Status Update
ADEQ APP Application Status
General Discussion

2:30 - 3:00 Meeting Summary and Wrap Up

Decisions
Action Items
Schedules

IUC Meeting - 11/10/98 1:00 p.m.

* D.T. explained backlog situation. Also discussed LTF provisions.

* Canyon Mine is the one that is wanted to be operated first. Milling needs & other contract effect when it will start - not just prices. 7-10 years life expected
* Spraying of water from pond for evaporation will be occurring.
* Financial Capability to be provided.
* They Need to provide a letter requesting elimination or reduction of monitoring
* They will provide closure report for Hermit Mine prior to 12/31/98. I will proceed with letter of clean closure following that.
* Kanab North mine to be discussed by IUC to either submit APP prior to 12/31/98 or perhaps vacate the GWQPP.
* Jay Das to conduct Hydro/Eng review for Canyon & Pinenut.

IUC
INTERNATIONAL
URANIUM (USA)
CORPORATION

WATER PERMITS
FEB 01 1999
RECEIVED

H.C. 64 • Box 153 • 2555 No. Highway 89A • Fredonia, AZ 86022 • 520 643 7321 (phone) • 520 643 7328 (fax)

January 29, 1999

VIA UPS
Mr. Craig DeWalt, REM
Arizona Department of Environmental Quality
3033 North Central Avenue, M0401A
Phoenix, Arizona 85012

Re: Hermit Mine - Clean Closure - Additional Information Requests

Dear Craig,

Pursuant to our telephone conversation on January 14, 1999, enclosed please find the additional information you requested in regard to the Hermit Mine Clean Closure report.

International Uranium (USA) Corporation is submitting two copies of the additional information you requested in order to facilitate expeditious review of the responses and supporting documentation. After reviewing the enclosed data should you have any questions or require additional information please feel free to call Mr. Roger Smith, General Manager of Mining Operations or me at 520-643-7321.

Very truly yours,

Donn M. Pillmore

Donn M. Pillmore
Project Manager

Enclosures

cc: Dennis L. Turner/ADEQ
Jayanta Das/ADEQ
R. B. Smith

WATER PERMITS

FEB 0 1 1999

RECEIVED

HERMIT MINE CLOSURE
ADDITIONAL INFORMATION REQUESTS PER PHONE CALL FROM CRAIG DEWALT W/ADEQ, JANUARY 14, 1999

1) Discrepancy between well registration number cited in the Notice of Disposal documentation (reg. # 55-517832) and the well registration number on the monitoring well (55-518877). Please clarify.

RESPONSE:

Energy Fuels Nuclear, Inc. selected a drilling contractor and commenced drilling a water supply well on July 10, 1987. The registration number of this well was 55-517832. The bore hole was drift surveyed at a depth of 975 feet, which revealed the bore hole had drifted excessively. Because the drilling contractor specified a maximum deviation of 4 degrees, which was exceeded, the contractor elected to abandon the job. The bore hole was abandoned and reclaimed on August 19, 1987 in compliance with state regulations and all necessary forms and notices filed with the State.

Drilling on the water well (Arizona Registration No. 55-518877) commenced on August 27, 1987, after receipt of the necessary drilling permits from the Arizona Department of Water Resources. This well was completed to a total depth of 3,030 feet on December 23, 1987. The hole bottomed in the Redwall Limestone Formation.

2) ADEQ needs a copy of the well completion/construction detail. Wants to know the TD of the well, where the aquifer was intersected, and where the pump is positioned. Also we need to verify the elevation of the bottom of the mine.

RESPONSE

The well was drilled to a total depth of 3,030 feet and bottomed in the Redwall Limestone Formation. Water was encountered at a depth of 2,855 feet and the pump was set at a depth of 1,917 feet. Dimensions and depths of the well and casing strings are presented as follows:

Hole Size and Depth	Casing Size and Length
12 1/4"- Surface to 20 feet	10", 1/4" wall, 17 feet
11" - 20 to 980 feet	8 5/8", 24 lb., 970 feet
7 7/8" - 980 to 1,810 feet	5 1/2", 14 lb., 1,798 feet
6 1/4" - 1,810 to 2,020 feet	Uncased hole from 1,798 feet to
4 3/4" - 2,020 to 3,030 feet	3,030 feet, TD

A casing grout job was performed on the 5 1/2" casing by Halliburton Co. of Farmington, NM on November 4, 1987. An expandable packer shoe was installed at the bottom of the 5 1/2" casing to protect the open hole below the 1,798 foot depth.

3) Latitude and Longitude of the monitor well.

RESPONSE:

Latitude: 36°41'21" N
Longitude: 112°45'04" W

4) A copy of the actual lab reports for all of the monitoring data, from mine closure in 1990 to present, that have been reported to the ADEQ on their data sheets.

RESPONSE:

A copy of the actual lab reports for all of the monitoring data from mine closure in 1990 to present are enclosed. Quarterly monitoring was being conducted between the 4th quarter 1990 (sample HER073) and the 2nd quarter in 1993 (sample HER137), for a total of 11 laboratory analyses. Bi-annual monitoring commenced in 1993 (sample HER148), for a total of 11 laboratory analyses.

5) A written explanation why the GWPP states that there will be a single pond with 12.6 acre feet and in fact we constructed 2 ponds (6.5 & 6.8 acre feet) and how this satisfied the requirements to be able to handle a 500 year storm event.

- "As Built" drawings of the pond for the file
- Documentation on pond construction if available
- Written statement that the ponds were inspected on a weekly basis, and that when the pond liner was salvaged what condition it was in and whether or not it was reused on another project

RESPONSE:

Two ponds were constructed at the Hermit Mine with a total capacity of 13.3 acre feet. The pond was originally going to be constructed as a single 12.6 acre feet pond, but to facilitate mining operations the pond was constructed as two cells joined together with a spillway. The resultant facility was two cells, a 6.5 acre feet cell and a 6.8 acre feet cell. During life of the mining operation, it was only necessary to use the 6.5 acre feet cell, the 6.8 acre feet cell was never required for water strorage.

An "as built" drawing of the pond can not be located, although, an "in-house" memorandum discussing the Hermit Pond Liner Installation is enclosed for your review. The two celled pond

was inspected on a weekly basis to check the pond liner and verify there were no rips or damage which could cause leakage. The pond liner was salvage during reclamation activities for future use on other mining operations.

6) Prepare and submit a summation of the monitor well water analysis from mine shut down in 1990 to present. Include a statement to the effect that since there have not been any significant fluctuations in the monitoring results, that monitoring at the Hermit mine should be terminated.

RESPONSE:

A summary of all of the monitor well water analysis, from mine shut down in 1990 to present, has been prepared and is attached herewith. As noted in 4) above, quarterly monitoring was being conducted between the 4th quarter 1990 (sample HER073) and the 2nd quarter in 1993 (sample HER137), for a total of 11 laboratory analyses. Bi-annual monitoring commenced in 1993 (sample HER148), for a total of 11 laboratory analyses.

7) There was a letter, written March 8, 1995 by Roger Smith, that states steps will be taken to resolve the apparent exceedences from analysis performed on water samples from the monitoring well. Was there any follow-up to this letter?

RESPONSE:

No follow up letters or data can be located, however, it was determined at the time the malfunctioning pump was pulled from the well, that water samples were contaminated from heavy build up of scale material accumulated on the inside and outside of the pump discharge column. Also, a condition of natural occurring electrolysis at the pump elevation took place, significantly replacing the metal pump stator and column pipe with other minerals and metals. This condition clearly contributed to the minor exceedences detected during on going analysis of water from the monitor well.

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1-Feb-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 3
Set : 1

Attn:
Project:

PO #:

Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	CO3 as CaCO3 mg/l	HCO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l
HER073	161	<1	161	40	7.38	3470	3380

Sample	TSS mg/l	NO3 as N mg/l	PO4 as P mg/l	SO4 mg/l	SiO2 mg/l	As Total mg/l	Ba Total mg/l
HER073	<4	<0.1	<0.1	1830	13.0	0.002	0.01

Sample	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l	F mg/l	Fe Total mg/l
HER073	525	<0.005	<0.01	<0.01	1.5	9.47

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1-Feb-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 2
Copy: 1 of 3
Set : 1

Attn:
Project:

PO #:

Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	K Total mg/l	Ag Total mg/l
HER073	<0.02	177	0.12	<0.0002	20.1	0.01

Sample	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HER073	<0.002	78.1	0.111	58	±26

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1-Feb-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 3
Copy: 1 of 3
Set : 1

Attn:
Project:

PO #:

Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Ra-228 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*
HER073	48	±14	3.2	±0.6	1.5	±1.3	0.0	±0.5

Sample	U Total mg/l
HER073	0.0009

Should be more like ≈0.9 mg/L (90 ppb) compared to 58 ±26 pCi/L gross alpha

The font is smaller than (where it can be seen) on the following pages

Why was Barringer Laboratories still used after they performed poorly on the Lab Accuracy test?

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

RECEIVED

2-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 3
Set : 1

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm
HER094	154	154	<1	41	6.84	2440

Sample	TDS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l	Ag Total mg/l
HER094	3250	<0.1	<0.1	2290	12.6	<0.01

Sample	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l
HER094	0.002	0.01	513	<0.005	<0.01	<0.01

Sample	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HER094	1.6	6.41	<0.02	161	0.09	<0.0002

Sample	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ
HER094	20.7	<0.002	68.6	<0.005	71	±31

<0.1 mg/L (100 ppb)

Sample	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER094	27	±15	2.4	±0.5	0.0	±0.4	0.0027

2.7 ppb

Is this letterhead a photocopy of a photocopy?

Engineering Challenges Of A Changing World

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

22-May-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Min
PO #:

Received: 3-May-91 10:06

Job: 91830E
Status: Final

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm
HER100	162	162	<1	40	7.56	2580

Sample	TDS mg/l	TSS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l
HER100	3360	17	<0.1	<0.1	2270	12.7

Sample	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l
HER100	<0.01	<0.001	0.01	579	0.009	0.01

Sample	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER100	<0.01	1.5	7.07	<0.02	191	0.09

Sample	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l
HER100	<0.0002	21.7	<0.001	75.1	<0.005

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ
HER100	10	±19	15	±14	3.5	±0.7

Gross alpha would not be lower than gross beta

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

22-May-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 2
Copy: 1 of 3
Set : 1

Attn:
Project: Hermit Min

Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

Sample Type: Water

Sample	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER100	0.0	±0.5	0.0016

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Oct-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 3
Set : 1

Attn:
Project:

PO #:

Received: 26-Sep-91 10:42

Job: 911810E

Status: Final

Sample Type: Water

Sample	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l
HER 112	<0.01	0.006	0.02	658	<0.005	0.02

Sample	Cu Total mg/l	F Total mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER 112	0.01	<0.1	9.3	<0.02	218	0.12

Sample	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Alkalinity as CaCO3 mg/l
HER 112	<0.0002	25	<0.002	91	<0.005	177

Sample	pH unit	TDS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 Dissolved mg/l
HER 112	7.09	3280	0.2	<0.1	1860	14

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	Specific Conductance µmho/cm	Gross Alpha Total pCi/l	Error 2σ
HER 112	177	<1	72	3140	27	±21

≈0.04 mg/L (40 ppb)

Sample	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER 112	24	±13	2.8	±0.6	0.0	±0.5	<0.0003 *

* Verified by reanalysis.

The method used has a LLD of 0.005 - this measurement is not possible

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

20-Jan-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Attn: Lawrence Casebolt
Project:

Received: 6-Jan-92 11:29
PO #:

Job: 923028E

Status: Final

Sample Type: Water

Sample	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l
HER 114	<0.01	<0.001	0.01	571	<0.005	0.03

Sample	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER 114	0.02	0.5	6.61	<0.02	184	0.09

Sample	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Alkalinity as CaCO3 mg/l
HER 114	<0.0002	20.2	<0.002	73.3	0.005	173

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Conductance µmho/cm	TDS mg/l
HER 114	173	<1	38	6.95	4140	3760

Sample	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 Total mg/l	Gross Alpha Total pCi/l	Error 2σ
HER 114	0.9	*<1	2290	13.4	12	±18

Sample	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER 114	37	±13	1.9	±0.5	0.0	±0.5	0.0019

Gross beta can not be higher than gross alpha

BARRINGER LABORATORIES INC.
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13-May-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Attn:
Project:

PO #:

Received: 3-Apr-92 09:18

Job: 923806E

Status: Final

Parameter			HER 120 Water
Silver	Total	mg/l	<0.01
Arsenic	Total	mg/l	0.002
Barium	Total	mg/l	0.04
Calcium	Total	mg/l	566
Cadmium	Total	mg/l	<0.005
Chromium	Total	mg/l	0.03
Copper	Total	mg/l	0.03
Fluoride		mg/l	0.9
Iron	Total	mg/l	6.1
Lead	Total	mg/l	<0.02
Magnesium	Total	mg/l	191
Manganese	Total	mg/l	0.10
Mercury	Total	mg/l	<0.0002
Potassium	Total	mg/l	21.3
Selenium	Total	mg/l	<0.002
Sodium	Total	mg/l	75.5
Zinc	Total	mg/l	0.052
Alkalinity	as CaCO3	mg/l	168
HCO3	as CaCO3	mg/l	169
CO3	as CaCO3	mg/l	<1
Chloride		mg/l	40
pH		unit	7.89
Specific	Conductance	µmho/cm	3060
TDS		mg/l	3410
NO3 as N		mg/l	<0.1
Phosphate		mg/l	<0.1
Sulfate		mg/l	2200
Silica	Total	mg/l	17.0



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13-May-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 2
Copy: 1 of 2
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Attn:
Project:

PO #:

Received: 3-Apr-92 09:18

Job: 923806E

Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ
HER 120	9	±20	44	±15	8.9	±1.7	0.0	±0.5

Beta would not be higher than Alpha
U is highest contributor to Alpha, maybe
Gross Alpha excludeds alpha from U?

Sample	U Total mg/l	U Total pCi/l(1)
HER 120	0.0008	0.5

Lab did not have the capabilities to measure the U concentration this small and to this precision

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21-Oct-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Attn: Lawrence Casebolt
Project: Hermit Mine Well

Received: 30-Sep-92 09:30
PO #:

Job: 925116E

Status: Final

Parameter			HER126 Water
Silver	Total	mg/l	<0.01
Arsenic	Total	mg/l	<0.001
Barium	Total	mg/l	0.01
Calcium	Total	mg/l	524
Cadmium	Total	mg/l	<0.005
Chromium	Total	mg/l	<0.01
Copper	Total	mg/l	<0.01
Fluoride		mg/l	3.1
Iron	Total	mg/l	5.40
Lead	Total	mg/l	<0.02
Magnesium	Total	mg/l	204
Manganese	Total	mg/l	0.06
Mercury	Total	mg/l	0.0002
Potassium	Total	mg/l	21.7
Selenium	Total	mg/l	<0.002
Sodium	Total	mg/l	79.1
Zinc	Total	mg/l	0.038
Alkalinity	as CaCO3	mg/l	160
CO3	as CaCO3	mg/l	<1.0
HCO3	as CaCO3	mg/l	160
Chloride		mg/l	41
pH		unit	6.98
Conductance		µmho/cm	3700
TDS		mg/l	3330
NO3 as N		mg/l	<0.1
Phosphate		mg/l	<0.1
Sulfate		mg/l	2280
Silica	Total	mg/l	6.13

BARRINGER LABORATORIES, INC.
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21-Oct-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn: Lawrence Casebolt
Project: Hermit Mine Well PO #:

Received: 30-Sep-92 09:30

Job: 925116E Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ
HER126	24	±22	34	±12	10	±2

Sample	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER126	0.0	±1.0	0.0068

— See HER127 ATTACHED FOR RE-ANALYSIS of U

BARRINGER LABORATORIES, INC.
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10-Nov-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: R-1
Copy: 1 of 2

Attn: Lawrence Casebolt
Project: Hermit Mine Well

Received: 6-Nov-92 09:30
PO #:

Job: 925466E

Status: Final

Sample Type: Water

Sample	U Total mg/l
HER127	0.0005

Lab did not have the capability to measure U concentrations this small
Method used only could measure to 0.005 not to 0.0005 mg/L

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

5-Aug-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 2
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Attn:
Project: Hermit Mine H2O Well PO #:

Received: 6-Jul-92 09:30

Job: 924506E Status: Final

Sample Type: Water

Sample	Silver Total mg/l	Arsenic Total mg/l	Barium Total mg/l	Calcium Total mg/l	Cadmium Total mg/l	Chromium Total mg/l	Copper Total mg/l
HER122	<0.01	0.003	<0.01	587	<0.005	<0.01	<0.01

Sample	Fluoride Total mg/l	Iron Total mg/l	Lead Total mg/l	Magnesium Total mg/l	Manganese Total mg/l	Mercury Total mg/l
HER122	1.6	5.64	<0.02	199	0.07	<0.0002

Sample	Potassium Total mg/l	Selenium Total mg/l	Sodium Total mg/l	Zinc Total mg/l	Alkalinity as CaCO3 mg/l	CO3 as CaCO3 mg/l
HER122	21.4	<0.002	78.6	0.176	159	<1

Sample	HCO3 as CaCO3 mg/l	Chloride mg/l	pH unit	Conductance µmho/cm	TDS mg/l	NO3 as N mg/l
HER122	159	35	7.37	1500	3410	0.2

Sample	Phosphate mg/l	Sulfate mg/l	SIO mg/l
HER122	<0.1	2100	5.40

BARRINGER LABORATORIES INC.
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5-Aug-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Mine H2O Well PO #:

Received: 6-Jul-92 09:30

Job: 924506E Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ
HER122	24	±16	32	±14	3.1	±0.9	0.0	±0.5

Gross alpha would be higher than gross beta

Sample	U Total mg/l	U Total pCi/l(1)
HER122	0.0004	0.3

Alpha decay from uranium is the largest contributor to gross alpha

If gross alpha really is 24 pCi/L then U ≈21 pCi/L would correlate to ≈0.03 mg/L (30 ppb)

BARRINGER LABORATORIES INC.
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18-Jan-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

When collected?

Attn: Lawrence Casebolt
Project: Hermit Mine Well PO #:

Received: 15-Dec-92 09:30

Job: 925747E Status: Final

Sample Type: Water

Sample	Silver Total mg/l	Arsenic Total mg/l	Barium Total mg/l	Calcium Total mg/l	Cadmium Total mg/l	Chromium Total mg/l	Copper Total mg/l
HER129	<0.01	0.003	0.01	618	<0.005	<0.01	<0.01

Sample	Fluoride mg/l	Iron Total mg/l	Lead Total mg/l	Magnesium Total mg/l	Manganese Total mg/l	Mercury Total mg/l
HER129	1.5	4.83	0.03	208	0.05	<0.0002

Sample	Potassium Total mg/l	Selenium Total mg/l	Sodium Total mg/l	Zinc Total mg/l	Alkalinity as CaCO3 mg/l	CO3 as CaCO3 mg/l
HER129	23.9	0.032	84.4	<0.005	158	<1

HCO3 (bicarbonate) is not the same as CaCO3 (carbonate)

Sample	HCO3 as CaCO3 mg/l	Chloride mg/l	pH unit	Conductance µmho/cm	TDS mg/l	NO3 as N mg/l
HER129	158	37	6.87	3520	3410	<0.1

Sample	Phosphate Dissolved mg/l	Sulfate mg/l	Silica Total mg/l
HER129	<0.1	2130	6.17

Increasing sulfate could be due to oxidation of sulfide mineralization, which would lower pH. If oxidation of sulfide mineralization is occurring, so can oxidation of the uraninite

BARRINGER LABORATORIES INC.
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18-Jan-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn: Lawrence Casebolt
Project: Hermit Mine Well

Received: 15-Dec-92 09:30
PO #:

Job: 925747E

Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ
HER129	46	±29	48	±13	5.8	±1.3

Sample	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER129	1.6	±0.8	0.0005

46 pCi/L ≈0.07 mg/L (70 ppb)

Uranium concentration is increasing with sulfate concentration

BARRINGER LABORATORIES INC.
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16-Jul-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 21-Jun-93 09:45

Job: 937485E

Status: Final

Sample Type: Water

Sample Id	Silver Total mg/l	Arsenic Total mg/l	Barium Total mg/l	Calcium Total mg/l	Cadmium Total mg/l
HER 137	<0.01	<0.001	0.01	652	<0.005

Sample Id	Chromium Total mg/l	Copper Total mg/l	Fluoride Total mg/l	Iron Total mg/l	Lead Total mg/l
HER 137	<0.01	<0.01	2.8	4.77	<0.02

Sample Id	Magnesium Total mg/l	Manganese Total mg/l	Mercury Total mg/l	Potassium Total mg/l	Selenium Total mg/l
HER 137	208	0.06	<0.0002	23.4	<0.002

Sample Id	Sodium Total mg/l	Zinc Total mg/l	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l
HER 137	83.0	<0.005	162	162	<1

Sample Id	Chloride mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l	TSS mg/l
HER 137	37	6.93	2030	3450	8

Sample Id	NO3 as N mg/l	Phosphate mg/l	Sulfate mg/l	Silica Total mg/l
HER 137	<0.1	<0.1	2280	6.12

Sulfate still increasing, pH still below 7

BARRINGER LABORATORIES INC.
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16-Jul-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: R-2
Copy: 1 of 2

Attn:
Project:

PO #:

Received: 21-Jun-93 09:45

Job: 937485E

Status: Final

Sample Type: Water

Sample Id	Gross Alpha Total pCi/l	± 2σ	Gross Beta Total pCi/l	± 2σ
HER 137	34	±25	58	±26

Gross Alpha should not be lower than Gross Beta

Sample Id	Ra-226 Total pCi/l	± 2σ	Ra-228 Total pCi/l	± 2σ
HER 137	9.3	±2.1	0.9	±1.9

Sample Id	Th-230 Total pCi/l	± 2σ	U Total mg/l
HER 137	0.2	±0.8	0.0022

How id lab measure this concentration?

BARRINGER LABORATORIES INC.
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9-Apr-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 11-Mar-93 10:15

Job: 936525E

Status: Final

Sample Type: Water

Sample	Silver Total mg/l	Arsenic Total mg/l	Barium Total mg/l	Calcium Total mg/l	Cadmium Total mg/l	Chromium Total mg/l	Copper Total mg/l
HER134	<0.01	0.005	0.01	600	<0.005	<0.01	<0.01

Sample	Fluoride Total mg/l	Iron Total mg/l	Lead Total mg/l	Magnesium Total mg/l	Manganese Total mg/l	Mercury Total mg/l
HER134	2.1	4.62	<0.02	200	0.05	<0.0002

Sample	Potassium Total mg/l	Selenium Total mg/l	Sodium Total mg/l	Zinc Total mg/l	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l
HER134	22.8	<0.002	79.7	<0.005	152	152

Sample	CO3 as CaCO3 mg/l	Chloride mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l	NO3 mg/l
HER134	<1	38	6.90	3040	2790	<0.1

Sample	Phosphate Dissolved mg/l	Sulfate mg/l	Silicon Dissolved mg/l
HER134	<0.02	1960	6.23

sulfate decreasing

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

12-Apr-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: R-6
Copy: 1 of 2

Attn:
Project:

PO #:

Received: 11-Mar-93 10:15

Job: 936525E

Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l ± 2σ	Gross Beta Total pCi/l ± 2σ	Ra-226 Total pCi/l ± 2σ
HER134	23 ±22	27 ±14	9.0 ±1.5

Sample	Th-230 Total pCi/l ± 2σ	U Total mg/l
HER134	0.4 ±0.6	0.0006

Barringer could not have measured this low of a concentration or to this precision

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

ENERGY FUELS NUCLEAR

Sample Id: HER148
Lab Id: 939356-1 **Project: HER148**
Date Sampled: 16-Dec-93 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Dissolved	200.7	U mg/l	0.01	17-Jan-94
Arsenic	Dissolved	206.2	U mg/l	0.001	5-Jan-94
Barium	Dissolved	200.7	0.01 mg/l	0.01	17-Jan-94
Calcium	Dissolved	200.7	628 mg/l	0.05	17-Jan-94
Cadmium	Dissolved	200.7	U mg/l	0.005	17-Jan-94
Chromium	Dissolved	200.7	U mg/l	0.01	17-Jan-94
Copper	Dissolved	200.7	U mg/l	0.01	17-Jan-94
Fluoride		300.0	3.0 mg/l	0.1	17-Jan-94
Iron	Dissolved	200.7	4.27 mg/l	0.02	17-Jan-94
Lead	Dissolved	200.7	U mg/l	0.02	17-Jan-94
Magnesium	Dissolved	200.7	212 mg/l	0.05	17-Jan-94
Manganese	Dissolved	200.7	0.05 mg/l	0.01	17-Jan-94
Mercury	Dissolved	245.1	U mg/l	0.0002	11-Jan-94
Potassium	Dissolved	200.7	24.0 mg/l	0.5	17-Jan-94
Selenium	Dissolved	270.2	U mg/l	0.002	5-Jan-94
Sodium	Dissolved	200.7	86.2 mg/l	0.05	17-Jan-94
Zinc	Dissolved	200.7	U mg/l	0.005	17-Jan-94
Alkalinity		310.1	160 mg/l	1	4-Jan-94
HCO3		310.1	160 mg/l	1	4-Jan-94
CO3		310.1	U mg/l	1	4-Jan-94
Chloride		300.0	38 mg/l	1	17-Jan-94
pH		150.1	7.02 unit	0.01	22-Dec-93
Spec. Cond.		120.1	3330 µmh/cm	1	7-Jan-94
TDS		160.1	3320 mg/l	4	27-Dec-93
NO3 as N		353.2	U mg/l	0.1	14-Jan-93
Phosphate as P		365.1	U mg/l	0.1	10-Jan-94
Sulfate		300.0	2200 mg/l	1	17-Jan-94
Silicon	Dissolved	200.7	6.50 mg/l	0.01	17-Jan-94

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ENERGY FUELS NUCLEAR

Sample Id: HER148
Lab Id: 939356-1
Date Sampled: 16-Dec-93

Project: HER148
Matrix: Water

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Gross Alpha	Dissolved	51±20	pCi/l ✓	2	01/05-01/06
Gross Beta	Dissolved	46±14	pCi/l	4	01/05-01/06
Ra-226	Dissolved	10±2	pCi/l	0.3	01/10-01/24
Ra-228	Dissolved	0.4±1.4	pCi/l	1	01/04-01/07
Th-230	Dissolved	0.4±0.7	pCi/l	0.4	01/19-01/27
U	Dissolved	0.0003	mg/l	0.0003	12/29-01/04

What method was used that has this precision?

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ENERGY FUELS NUCLEAR

Sample Id: HER150
Lab Id: 941486-1 **Project: Hermit Mine**
Date Sampled: 3-Mar-94 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	29-Mar-94
Arsenic	Total	206.2	0.002 mg/l	0.001	14-Mar-94
Barium	Total	200.7	0.01 mg/l	0.01	29-Mar-94
Calcium	Total	200.7	623 mg/l	0.05	29-Mar-94
Cadmium	Total	200.7	0.007 mg/l	0.005	29-Mar-94
Chromium	Total	200.7	U mg/l	0.01	29-Mar-94
Copper	Total	200.7	U mg/l	0.01	29-Mar-94
Fluoride	Total	300.0	2.8 mg/l	0.1	5-Apr-94
Iron	Total	200.7	4.24 mg/l	0.02	29-Mar-94
Lead	Total	200.7	U mg/l	0.02	29-Mar-94
Magnesium	Total	200.7	201 mg/l	0.05	29-Mar-94
Manganese	Total	200.7	0.05 mg/l	0.01	29-Mar-94
Mercury	Total	245.1	U mg/l	0.0002	24-Mar-94
Potassium	Total	200.7	21.1 mg/l	0.5	29-Mar-94
Selenium	Total	270.2	U mg/l	0.002	14-Mar-94
Sodium	Total	200.7	78.7 mg/l	0.05	29-Mar-94
Zinc	Total	200.7	U mg/l	0.005	29-Mar-94
Alkalinity		310.1	163 mg/l	1	25-Mar-94
HCO3		310.1	163 mg/l	1	25-Mar-94
CO3		310.1	U mg/l	1	25-Mar-94
Chloride		300.0	37 mg/l	1	5-Apr-94
pH		150.1	7.00 unit	0.01	11-Mar-94
Spec. Cond.		120.1	3434 µmh/cm	1	16-Mar-94
TDS		160.1	3250 mg/l	4	15-Mar-94
NO3 as N		353.2	U mg/l	0.1	31-Mar-94
Phosphate as P		365.1	U mg/l	0.1	8-Apr-94
Sulfate		300.0	2290 mg/l	1	5-Apr-94
Silicon	Total	200.7	6.30 mg/l	0.01	29-Mar-94

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ENERGY FUELS NUCLEAR

Sample Id: HER150
Lab Id: 941486-1 **Project: Hermit Mine**
Date Sampled: 3-Mar-94 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Gross Alpha	Total	15±13	pCi/l	2	03/29-03/30
Gross Beta	Total	21±14	pCi/l	4	03/29-03/30
Ra-226	Total	8.9±1.3	pCi/l	0.3	03/17-03/23
Ra-228	Total	0.8±1.0	pCi/l	1	03/16-03/28
Th-230	Total	0.5±0.7	pCi/l	0.4	03/16-03/17
U	Total	U	mg/l	0.0003	03/23-03/28

LLD is 0.005 mg/L not 0.0003

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ENERGY FUELS NUCLEAR

Sample Id: HER 167
Lab Id: 943646-1 **Project:**
Date Sampled: 9-Dec-94 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	29-Dec-94
Arsenic	Total	206.2	0.003 mg/l	0.003	29-Dec-94
Barium	Total	200.7	U mg/l	0.02	29-Dec-94
Calcium	Total	200.7	660 mg/l	0.2	29-Dec-94
Cadmium	Total	200.7	U mg/l	0.005	29-Dec-94
Chromium	Total	200.7	U mg/l	0.01	29-Dec-94
Copper	Total	200.7	U mg/l	0.01	29-Dec-94
Iron	Total	200.7	4.3 mg/l	0.1	29-Dec-94
Lead	Total	239.2	0.005 mg/l	0.002	29-Dec-94
Magnesium	Total	200.7	205 mg/l	0.1	29-Dec-94
Manganese	Total	200.7	0.055 mg/l	0.005	29-Dec-94
Mercury	Total	245.1	U mg/l	0.0002	21-Dec-94
Potassium	Total	200.7	23 mg/l	5	29-Dec-94
Selenium	Total	270.2	U mg/l	0.005	29-Dec-94
Sodium	Total	200.7	83 mg/l	1	29-Dec-94
Zinc	Total	200.7	U mg/l	0.02	29-Dec-94
Silica	Total	200.7	13 mg/l	2	29-Dec-94
Fluoride		300.0	3.2 mg/l	0.1	5-Jan-95
Alkalinity	Total	310.1	159 mg/l	1	28-Dec-94
Alkalinity	HCO3	310.1M	159 mg/l	1	28-Dec-94
Alkalinity	CO3	310.1M	U mg/l	1	28-Dec-94
Chloride		300.0	39 mg/l	1	5-Jan-95
pH		150.1	7.06 unit	0.01	20-Dec-94
Spec. Cond.		120.1	3270 µmh/cm	1	20-Dec-94
TDS		160.1	3240 mg/l	10	16-Dec-94
Nitrate as N		300.0	U mg/l	0.1	5-Jan-95
ortho-Phosphate		365.1	U mg/l	0.02	22-Dec-94
Sulfate		300.0	2240 mg/l	1	5-Jan-95

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ENERGY FUELS NUCLEAR

Sample Id: HER 167
Lab Id: 943646-1 **Project:**
Date Sampled: 9-Dec-94 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Gross Alpha	Total	11±17	pCi/l	2	12/19-12/20
Gross Beta	Total	12±12	pCi/l	4	12/19-12/20
Ra-226	Total	7.4±0.8	pCi/l	0.2	12/20-12/22
Ra-228	Total	0.9±0.7	pCi/l	1	12/23-12/29
Th-230	Total	0.4±0.3	pCi/l	0.2	12/20-12/22

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ENERGY FUELS NUCLEAR

Sample Id: HER 167
Lab Id: 943646-1 **Project:**
Date Sampled: 9-Dec-94 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Uranium	Total	0.0019	mg/l	0.0003	12/19-12/20

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ENERGY FUELS NUCLEAR

Sample Id: HER 176
Lab Id: 952511-1 **Project:**
Date Sampled: 21-Jun-95 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	11-Jul-95
Arsenic	Total	206.2	U mg/l	0.003	12-Jul-95
Barium	Total	200.7	U mg/l	0.02	11-Jul-95
Calcium	Total	200.7	592 mg/l	0.2	11-Jul-95
Cadmium	Total	200.7	U mg/l	0.005	11-Jul-95
Chromium	Total	200.7	U mg/l	0.01	11-Jul-95
Copper	Total	200.7	U mg/l	0.01	11-Jul-95
Iron	Total	200.7	4.1 mg/l	0.1	11-Jul-95
Lead	Total	239.2	0.005 mg/l	0.002	11-Jul-95
Magnesium	Total	200.7	197 mg/l	0.1	11-Jul-95
Manganese	Total	200.7	0.046 mg/l	0.005	11-Jul-95
Mercury	Total	245.1	U mg/l	0.0002	10-Jul-95
Potassium	Total	200.7	22 mg/l	5	11-Jul-95
Selenium	Total	270.2	U mg/l	0.005	11-Jul-95
Sodium	Total	200.7	79 mg/l	1	11-Jul-95
Zinc	Total	200.7	U mg/l	0.02	11-Jul-95
Fluoride		300.0	1.1 mg/l	0.2	28-Jun-95
Alkalinity	CO3	310.1M	U mg/l	1	6-Jul-95
Alkalinity	HCO3	310.1M	172 mg/l	1	6-Jul-95
Chloride		300.0	35 mg/l	2	28-Jun-95
pH		150.1	7.25 unit	0.01	28-Jun-95
Spec. Cond.		120.1	3420 µmh/cm	1	6-Jul-95
TDS		160.1	3200 mg/l	10	29-Jun-95
Nitrate as N		300.0	U mg/l	0.2	28-Jun-95
Phosphorus	Total	365.1	U mg/l	0.05	5-Jul-95
Sulfate		300.0	2180 mg/l	50	28-Jun-95
Silica	Total	200.7	13 mg/l	2	11-Jul-95

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ENERGY FUELS NUCLEAR

Sample Id: HER 176
Lab Id: 952511-1 **Project:**
Date Sampled: 21-Jun-95 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Gross Alpha	Total	53±25	pCi/l	2	07/18-07/24
Gross Beta	Total	60±20	pCi/l	4	07/18-07/24
Ra-226	Total	10±1	pCi/l	0.3	07/07-07/10
Ra-228	Total	0.4±0.9	pCi/l	1	07/12-07/18
Th-230	Total	0.6±0.6	pCi/l	0.4	07/24-07/26

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ENERGY FUELS NUCLEAR

Sample Id: HER 176
Lab Id: 952511-1 **Project:**
Date Sampled: 21-Jun-95 **Matrix: Water**

Analyte	Fraction	Conc.		LLD	Date Analyzed
Uranium	Total	0.0007	mg/l	0.0003	07/10-07/12

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ENERGY FUELS NUCLEAR

Sample Id: HER183
Lab Id: 953896-1 **Project:**
Date Sampled: 14-Nov-95 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	22-Nov-95
Arsenic	Total	206.2	*U mg/l	0.003	7-Dec-95
Barium	Total	200.7	U mg/l	0.02	22-Nov-95
Calcium	Total	200.7	652 mg/l	0.2	22-Nov-95
Cadmium	Total	200.7	U mg/l	0.005	22-Nov-95
Chromium	Total	200.7	U mg/l	0.01	22-Nov-95
Copper	Total	200.7	U mg/l	0.01	22-Nov-95
Iron	Total	200.7	4.5 mg/l	0.1	22-Nov-95
Lead	Total	239.2	U mg/l	0.002	8-Dec-95
Magnesium	Total	200.7	217 mg/l	0.1	22-Nov-95
Manganese	Total	200.7	0.055 mg/l	0.005	22-Nov-95
Mercury	Total	245.1	U mg/l	0.0002	5-Dec-95
Potassium	Total	200.7	22 mg/l	5	28-Nov-95
Selenium	Total	270.2	U mg/l	0.005	7-Dec-95
Sodium	Total	200.7	87 mg/l	1	22-Nov-95
Zinc	Total	200.7	U mg/l	0.02	22-Nov-95
Fluoride		340.2	1.7 mg/l	0.1	30-Nov-95
Alkalinity	CO3	310.1M	U mg/l	5	21-Nov-95
Alkalinity	HCO3	310.1M	164 mg/l	5	21-Nov-95
Chloride		300.0	36 mg/l	1	6-Dec-95
pH		150.1	7.07 unit	0.01	21-Nov-95
Spec. Cond.		120.1	3410 µmh/cm	1	21-Nov-95
TDS		160.1	3220 mg/l	10	21-Nov-95
Nitrate as N		300.0	U mg/l	0.1	6-Dec-95
ortho-Phosphate		365.1	U mg/l	0.05	27-Nov-95
Sulfate		300.0	2280 mg/l	25	6-Dec-95
Silica	Total	200.7	14 mg/l	2	22-Nov-95

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ENERGY FUELS NUCLEAR

Analyte: Gross Alpha **Project:**
Fraction: Dissolved **Date Analyzed: 11/27-12/01**
Method: 900.0 **LLD: 2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	15±17	2

Analyte: Gross Beta **Project:**
Fraction: Dissolved **Date Analyzed: 11/27-12/01**
Method: 900.0 **LLD: 4**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	44±17	4

Analyte: Ra-226 **Project:**
Fraction: Dissolved **Date Analyzed: 11/28-12/04**
Method: SM-705 **LLD: 0.2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	7.3±0.8	0.2

Analyte: Ra-228 **Project:**
Fraction: Dissolved **Date Analyzed: 11/22-11/29**
Method: Perc/Brooks **LLD: 1**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	1.1±0.9	1

Analyte: Th-230 **Project:**
Fraction: Dissolved **Date Analyzed: 12/04-12/07**
Method: USAEC **LLD: 0.2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	0.0±0.1	0.2

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ENERGY FUELS NUCLEAR

Analyte: Uranium **Project:**
Fraction: Dissolved **Date Analyzed: 11/27-11/28**
Method: ASTM D2907 **LLD: 0.0003**
Units: mg/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	LLD
953896-1	14-Nov-95	Water	HER183	U	0.0003

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ENERGY FUELS NUCLEAR

Sample Id: HER189
Lab Id: 962009-1 **Project:**
Date Sampled: 15-May-96 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	3-Jun-96
Arsenic	Total	206.2	U mg/l	0.003	3-Jun-96
Barium	Total	200.7	U mg/l	0.02	3-Jun-96
Calcium	Total	200.7	617 mg/l	0.2	3-Jun-96
Cadmium	Total	200.7	U mg/l	0.005	3-Jun-96
Chromium	Total	200.7	U mg/l	0.01	3-Jun-96
Copper	Total	200.7	U mg/l	0.01	3-Jun-96
Iron	Total	200.7	4.7 mg/l	0.1	3-Jun-96
Lead	Total	239.2	U mg/l	0.002	3-Jun-96
Magnesium	Total	200.7	208 mg/l	0.1	3-Jun-96
Manganese	Total	200.7	0.046 mg/l	0.005	3-Jun-96
Mercury	Total	245.1	U mg/l	0.0002	6-Jun-96
Potassium	Total	200.7	21 mg/l	5	6-Jun-96
Selenium	Total	270.2	U mg/l	0.005	3-Jun-96
Sodium	Total	200.7	76 mg/l	1	6-Jun-96
Zinc	Total	200.7	U mg/l	0.02	3-Jun-96
Fluoride		340.2	1.6 mg/l	0.1	1-Jun-96
Alkalinity	CO3	310.1M	U mg/l	1	23-May-96
Alkalinity	HCO3	310.1M	165 mg/l	1	23-May-96
Chloride		300.0	38 mg/l	1	28-May-96
pH		150.1	7.84 unit	0.01	23-May-96
Spec. Cond.		120.1	3380 µmh/cm	1	23-May-96
TDS		160.1	3360 mg/l	10	23-May-96
Nitrate as N		300.0	U mg/l	0.1	28-May-96
ortho-Phosphate		365.1	U mg/l	0.02	3-Jun-96
Sulfate		300.0	2500 mg/l	25	28-May-96
Silica	Dissolved	200.7	14 mg/l	2	3-Jun-96



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ENERGY FUELS NUCLEAR

Analyte: Gross Alpha **Project:**
Fraction: Dissolved **Date Analyzed: 06/10-06/18**
Method: 900.0 **LLD: 43**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration+ 2σ	LLD
962009-1	15-May-96	Water	HER189	35±21	43

Analyte: Gross Beta **Project:**
Fraction: Dissolved **Date Analyzed: 06/10-06/18**
Method: 900.0 **LLD: 32**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration+ 2σ	LLD
962009-1	15-May-96	Water	HER189	30±25	32

Analyte: Ra-226 **Project:**
Fraction: Dissolved **Date Analyzed: 05/23-05/28**
Method: SM-705 **LLD: 0.2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration+ 2σ	LLD
962009-1	15-May-96	Water	HER189	4.3±0.7	0.2

Analyte: Ra-228 **Project:**
Fraction: Dissolved **Date Analyzed: 05/29-06/03**
Method: Perc/Brooks **LLD: 1**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration+ 2σ	LLD
962009-1	15-May-96	Water	HER189	1.0±0.7	1

Analyte: Th-230 **Project:**
Fraction: Dissolved **Date Analyzed: 05/23-06/03**
Method: USAEC **LLD: 0.2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration+ 2σ	LLD
962009-1	15-May-96	Water	HER189	0.0±0.4	0.2

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ENERGY FUELS NUCLEAR

Analyte: Uranium **Project:**
Fraction: Dissolved **Date Analyzed: 05/28-05/30**
Method: ASTM D2907 **LLD: 0.0003**
Units: mg/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	LLD
962009-1	15-May-96	Water	HER189	0.0018	0.0003

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ENERGY FUELS NUCLEAR

Sample Id: HER 192
Lab Id: 962678-1 **Project:**
Date Sampled: 31-Jul-96 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	20-Aug-96
Arsenic	Total	206.2	U mg/l	0.003	20-Aug-96
Barium	Total	200.7	U mg/l	0.02	20-Aug-96
Calcium	Total	200.7	604 mg/l	0.2	20-Aug-96
Cadmium	Total	200.7	U mg/l	0.005	20-Aug-96
Chromium	Total	200.7	U mg/l	0.01	20-Aug-96
Copper	Total	200.7	U mg/l	0.01	20-Aug-96
Iron	Total	200.7	4.0 mg/l	0.1	20-Aug-96
Lead	Total	239.2	U mg/l	0.002	20-Aug-96
Magnesium	Total	200.7	202 mg/l	0.1	20-Aug-96
Manganese	Total	200.7	0.044 mg/l	0.005	20-Aug-96
Mercury	Total	245.1	0.0002 mg/l	0.0002	13-Aug-96
Potassium	Total	200.7	22 mg/l	5	20-Aug-96
Selenium	Total	270.2	U mg/l	0.005	20-Aug-96
Sodium	Total	200.7	81 mg/l	1	20-Aug-96
Zinc	Total	200.7	U mg/l	0.02	20-Aug-96
Fluoride		340.2	1.7 mg/l	0.1	12-Aug-96
Alkalinity	CO3	310.1M	U mg/l	1	5-Aug-96
Alkalinity	HCO3	310.1M	160 mg/l	1	5-Aug-96
Chloride		300.0	36 mg/l	3	15-Aug-96
pH		150.1	7.20 unit	0.01	5-Aug-96
Spec. Cond.		120.1	3370 µmh/cm	1	7-Aug-96
TDS		160.1	3340 mg/l	10	6-Aug-96
Nitrate as N		353.2	0.1 mg/l	0.1	2-Aug-96
ortho-Phosphate		365.1	U mg/l	0.02	2-Aug-96
Sulfate		300.0	2240 mg/l	25	15-Aug-96
Silica	Total	200.7	14 mg/l	2	20-Aug-96

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ENERGY FUELS NUCLEAR

Analyte: Gross Alpha **Project:**
Fraction: Total **Date Analyzed: 08/06-08/13**
Method: 900.0 **LLD: 38**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	18±18	38

Analyte: Gross Beta **Project:**
Fraction: Total **Date Analyzed: 08/06-08/13**
Method: 900.0 **LLD: 70**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	5±31	70

Analyte: Ra-226 **Project:**
Fraction: Total **Date Analyzed: 08/08-08/13**
Method: SM-705 **LLD: 0.1**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	7.5±0.8	0.1

Analyte: Ra-228 **Project:**
Fraction: Total **Date Analyzed: 08/16-08/19**
Method: Perc/Brooks **LLD: 2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	0.0±1.0	2

Analyte: Th-230 **Project:**
Fraction: Total **Date Analyzed: 08/13-08/19**
Method: USAEC **LLD: 0.6**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	0.0±0.4	0.6

BARRINGER LABORATORIES, INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

ENERGY FUELS NUCLEAR

Analyte: Uranium
Fraction: Total
Method: ASTM D2907
Units: mg/l

Project:
Date Analyzed: 08/19-08/20
LLD: 0.0003

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	LLD
962678-1	31-Jul-96	Water	HER 192	0.0011	0.0003

BARRINGER LABORATORIES, INC.
15000 W. 6TH AVE., SUITE 300 Ggolden, CO 80401 (303) 277-1687 FAX (303) 277-1689

24-Jul-97
Page: R-2
Job: 972579E
Status: Final

INTERNATIONAL URANIUM (USA) CORPORATION

Sample Id: HER208
Lab Id: 972579-2 **Project:**
Date Sampled: 18-Jun-97 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	8-Jul-97
Arsenic	Total	206.2	0.005 mg/l	0.003	3-Jul-97
Barium	Total	200.7	U mg/l	0.02	8-Jul-97
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Cadmium	Total	200.7	U mg/l	0.005	8-Jul-97
Chromium	Total	200.7	U mg/l	0.01	8-Jul-97
Copper	Total	200.7	U mg/l	0.01	8-Jul-97
Iron	Total	200.7	2.1 mg/l	0.1	8-Jul-97
Lead	Total	239.2	U mg/l	0.002	3-Jul-97
Magnesium	Total	200.7	199 mg/l	0.1	8-Jul-97
Manganese	Total	200.7	0.040 mg/l	0.005	8-Jul-97
Mercury	Total	245.1	U mg/l	0.0002	11-Jul-97
Potassium	Total	200.7	21 mg/l	5	8-Jul-97
Selenium	Total	270.2	U mg/l	0.005	3-Jul-97
Sodium	Total	200.7	82 mg/l	1	8-Jul-97
Zinc	Total	200.7	U mg/l	0.02	8-Jul-97
[redacted]		[redacted]	[redacted]	[redacted]	[redacted]
Alkalinity	CO3	310.1M	U mg/l	1	26-Jun-97
Alkalinity	HCO3	310.1M	160 mg/l	1	26-Jun-97
Chloride		300.0	37 mg/l	2.0	15-Jul-97
pH		150.1	7.85 unit	0.01	26-Jun-97
Spec. Cond.		120.1	3100 µmh/cm	1	27-Jun-97
TDS		160.1	3320 mg/l	10	23-Jul-97
Nitrate as N		353.2	U mg/l	0.1	20-Jun-97
ortho-Phosphate		365.1	U mg/l	0.05	27-Jun-97
Sulfate		300.0	2340 mg/l	20	15-Jul-97
Silica	Total	200.7	14 mg/l	2	8-Jul-97

Is the letterhead a copy of a copy?

BARRINGER LABORATORIES, INC.
15000 W. 6TH AVE., SUITE 300 Ggolden, CO 80401 (303) 277-1687 FAX (303) 277-1689

24-Jul-97
Page: R-3
Job: 972579E
Status: Final

INTERNATIONAL URANIUM (USA) CORPORATION

Analyte: Gross Alpha **Project:**
Fraction: Dissolved **Date Analyzed: 07/11-07/12**
Method: 900.0 **LLD: sample specific**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
[redacted]					99
972579-2	18-Jun-97	Water	HER208	36±26	56

Why blocked ou?

Analyte: Gross Beta **Project:**
Fraction: Dissolved **Date Analyzed: 07/11-07/21**
Method: 900.0 **LLD: sample specific**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
[redacted]					120
972579-2	18-Jun-97	Water	HER208	8±47	103

Analyte: Ra-226 **Project:**
Fraction: Dissolved **Date Analyzed: 07/17-07/23**
Method: SM-705 **LLD: 0.1**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
[redacted]					0.1
[redacted]					0.1

Analyte: Th-230 **Project:**
Fraction: Dissolved **Date Analyzed: 06/26-07/17**
Method: USAEC **LLD: 0.3**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
[redacted]					
972579-2	18-Jun-97	Water	HER208	0.2±0.4	0.3

BARRINGER LABORATORIES, INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

24-Jul-97
Page: R-4
Job: 972579E
Status: Final

INTERNATIONAL URANIUM (USA) CORPORATION

Analyte: Uranium
Fraction: Dissolved
Method: ASTM D2907
Units: mg/l

Project:
Date Analyzed: 07/21-07/22
LLD: 0.0009

What date was sample received?

The LLD for ASTM D2907 is not 0.0009 mg/L

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	LLD
[redacted]					
972579-2	18-Jun-97	Water	HER208	U	0.0009

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry
(Withdrawn 2003)

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L14367-01***
Client Sample ID: *HER 208*
Client Project ID: *Hermit Mine Water*
ACZ Report ID: *RG46961*

International Uranium(U.S.A.) Corp.
2555 N. Hwy. 89A,HC 64 Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *6/18/97 13:30*
Date Received: *6/20/97*
Date Reported: *7/11/97*

Sample Matrix: *Ground Water*

Metals Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Calcium, total	M200.7 ICP	585		mg/L	0.2	1	7/11/97	ss
Magnesium, total	M200.7 ICP	199		mg/L	0.2	1	7/11/97	ss
[redacted]								

Metals Prep

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010 ICP						7/10/97	tw

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Fluoride	M340.2 - ISE	1.5		mg/L	0.1	0.5	7/10/97	kr
[redacted]								

Inorganic Qualifiers (based on EPA CLP 3/90):

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Spgs, CO 80487
(800) 334-5493

International Uranium(U.S.A) Corp.
2555 N. Hwy. 89A, HC 64 Box 153
Fredonia, AZ 86022

Att: Mr. Lawrence L. Casebolt

Lab Sample ID: ***L14367-01***
Client Sample ID: *HER 208*
Client Project ID: *Hermit Mine Water*
ACZ Report ID: *RC2160*

Date Sampled: *6/18/97*
Date Received: *6/20/97*
Date Reported: *7/11/97*

Matrix: *water*

Parameter	EPA Method	Result	Error (+/-)	Qual	Units	MDL	PQL	Date	Analyst
Ra226	SM7500	9.5	1.2		pCi/L	1	5	10-Jul-97	cbr

Remarks:

Inorganic Qualifiers (based on EPA CLP 3/90)

< = Analyte at a concentration less than the detection limit
B = Concentration for analyte estimated between MDL and PQL
PQL = Practical Quantitation Limit

RV Poulsen
VP-Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: *L16914-01*
Client Sample ID: *HER 218*
Client Project ID: *Hermit Mine Water Wl*
ACZ Report ID: *RG59870*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *12/30/97 16:00*
Date Received: *1/2/98*
Date Reported: *1/13/98*

Sample Matrix: *Ground Water*

Metals Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Arsenic, dissolved	M206.2 GFAA	0.001	B	mg/L	0.001	0.005	1/2/98	jb
Barium, dissolved	M200.7 ICP		U	mg/L	0.02	0.05	1/5/98	jaw
Cadmium, dissolved	M213.2 GFAA		U	mg/L	0.0005	0.003	1/6/98	kr
Calcium, dissolved	M200.7 ICP	596		mg/L	1	5	1/5/98	jaw
Chromium, dissolved	M218.2 GFAA		U	mg/L	0.001	0.005	1/8/98	kr
Copper, dissolved	M220.2 GFAA		U	mg/L	0.001	0.005	1/3/98	jb
Iron, dissolved	M200.7 ICP	2.51		mg/L	0.05	0.3	1/5/98	jaw
Lead, dissolved	M239.2 GFAA		U	mg/L	0.001	0.005	1/5/98	kr
Magnesium, dissolved	M200.7 ICP	194		mg/L	1	5	1/5/98	jaw
Manganese, dissolved	M200.8 ICP-MS	0.050		mg/L	0.002	0.01	1/9/98	fep
Mercury, dissolved	M245.1 CVAA		U	mg/L	0.0002	0.001	1/5/98	bg
Potassium, dissolved	M200.7 ICP	20		mg/L	2	5	1/5/98	jaw
Selenium, dissolved	M270.2 GFAA		U	mg/L	0.01	0.05	1/7/98	fp
Silica, dissolved	M200.7 ICP	13		mg/L	1	3	1/5/98	jaw
Silver, dissolved	M272.2 GFAA		U	mg/L	0.0005	0.003	1/7/98	fp
Sodium, dissolved	M200.7 ICP	75		mg/L	2	5	1/5/98	jaw
Uranium, dissolved	M200.8 ICP-MS	0.0007	B	mg/L	0.0005	0.003	1/9/98	fep
Zinc, dissolved	M289.2 GFAA	0.002	B	mg/L	0.001	0.005	1/13/98	fp

Both Mn & U were measured on a ICP-MS, why do MDL & PQL differ?

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	M2320B							
Bicarbonate as CaCO3		166		mg/L	2	10	1/2/98	sts
Carbonate as CaCO3			U	mg/L	2	10	1/2/98	sts
Hydroxide as CaCO3			U	mg/L	2	10	1/2/98	sts
Total Alkalinity		166		mg/L	2	10	1/2/98	sts
Cation-Anion Balance	Calculation							
Cation-Anion Balance		-0.5		%			1/13/98	calc
Sum of Anions		50.2		meq/L	0.1	0.5	1/13/98	calc
Sum of Cations		49.7		meq/L	0.1	0.5	1/13/98	calc
Chloride	M325.2 - Colorimetric (RFA)	35		mg/L	1	5	1/7/98	jb/mc
Conductivity @25C	M120.1 - Meter	3250		umhos/cm	1	10	1/2/98	sts
Fluoride	M340.2 - ISE	1.5		mg/L	0.1	0.5	1/12/98	sts
Nitrate as N, dissolved	M353.2 - Automated Cadmium Reduction	0.02	B	mg/L	0.02	0.1	1/2/98	ss
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	0.02	B	mg/L	0.02	0.1	1/2/98	ss
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		U	mg/L	0.01	0.05	1/2/98	ss

Qualifier Definitions (based on EPA/600/4-79/020)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

This letterhead appears to have been a photocopy also, location of footer varies

RV Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

ACZ Project ID: *L17178*
Client Project ID: *Hermit Mine Water WL*
ACZ Report ID: *RG61048*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *12/30/97*
Date Received: *1/2/98*
Date Reported: *2/2/98*

Radiochemistry

								Preparation			Analysis		
ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Method	Date	Analyst	Method	Date	Analyst
L17178-01	HER 218	Ground Water	Thorium 230, dissolved	0.2	0.1	0.18	pCi/L				ESM 4506	1/31/98	cb

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

R V Poulsen

Vice President of Operations: Ralph Poulsen

REPRC001Radchem Default98.01.02

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

ACZ Project ID: *L16914*
Client Project ID: *Hermit Mine Water Wl*
ACZ Report ID: *RG60094*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *12/30/97*
Date Received: *1/2/98*
Date Reported: *1/16/98*

Radiochemistry

								Preparation			Analysis		
ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Method	Date	Analyst	Method	Date	Analyst
L16914-01	HER 218	Ground Water	Gross Alpha	13	13	11	pCi/L	Method	1/14/98	jjs	SM7110 B	1/15/98	cbr
			Gross Beta	32	13	16	pCi/L	Method	1/14/98	jjs	SM7110 B	1/15/98	cbr
			Radium 226, dissolved	11.1	1	0.81	pCi/L	Method	1/13/98	jjs	SM7500 B	1/15/98	cbr
			Radium 228	1.65	0.53	1.1	pCi/L	Method	1/14/98	jjs	M9320	1/16/98	cbr

This "Gross Alpha" is just for Ra
Uranium is largest emitter of alpha particles

Notes:
RC970813-1
RC971209-2

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

REPRC001Radchem Default98.01.02

slightly different position than last page

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L16914-01***
Client Sample ID: *HER 218*
Client Project ID: *Hermit Mine Water Wl*
ACZ Report ID: *RG59870*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *12/30/97 16:00*
Date Received: *1/2/98*
Date Reported: *1/13/98*

Sample Matrix: *Ground Water*

pH (lab)	M150.1 - Electrometric	7.0		units	0.1	0.1	1/2/98	sts
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid		U	mg/L	0.005	0.03	1/2/98	ss
Residue, Filterable (TDS) @180C	M160.1 - Gravimetric	3460		mg/L	10	20	1/5/98	sts
Sulfate	M375.3 - Gravimetric	2180		mg/L	10	20	1/5/98	cj
TDS (calculated)	Calculation	3220		mg/L	10	50	1/13/98	calc
TDS (ratio - measured/calculated)	Calculation	1.08					1/13/98	calc

[redacted]

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

RVP

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L19143-02***
Client Sample ID: *HER223*
Client Project ID:
ACZ Report ID: *RG72276*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *6/25/98 11:00*
Date Received: *6/26/98*
Date Reported: *7/20/98*

Sample Matrix: *Ground Water*

Metals Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Arsenic, total	M206.2 GFAA	0.002	B	mg/L	0.001	0.005	7/8/98	jb
Barium, total	M200.7 ICP	0.013	B	mg/L	0.006	0.02	7/10/98	gg
Cadmium, total	M213.2 GFAA		U	mg/L	0.0005	0.003	7/4/98	jb
Calcium, total	M200.7 ICP	561		mg/L	0.4	2	7/10/98	gg
Chromium, total	M218.2 GFAA		U	mg/L	0.001	0.005	7/11/98	jb
Copper, total	M220.2 GFAA		U	mg/L	0.001	0.005	7/11/98	jb
Iron, total	M200.7 ICP	5.91		mg/L	0.02	0.1	7/10/98	gg
Lead, total	M239.2 GFAA		U	mg/L	0.001	0.005	7/10/98	jb
Magnesium, total	M200.7 ICP	190		mg/L	0.4	2	7/10/98	gg
Manganese, total	M200.8 ICP-MS	0.084		mg/L	0.002	0.01	7/14/98	fep
Mercury, total	M245.1 CVAA		U	mg/L	0.0002	0.001	7/10/98	bg
Potassium, total	M200.7 ICP	20.6		mg/L	0.6	2	7/10/98	gg
Selenium, total	SM 3500-Se C, AA-Hydride		U	mg/L	0.001	0.005	7/9/98	bg
Silica, total	M200.7 ICP	12.5		mg/L	0.4	1	7/10/98	gg
Silver, total	M272.2 GFAA		U	mg/L	0.0005	0.003	7/8/98	jb
Sodium, total	M200.7 ICP	74.2		mg/L	0.6	2	7/10/98	gg
Uranium, total	M200.8 ICP-MS		U	mg/L	0.0005	0.003	7/14/98	fep
Zinc, total	M200.7 ICP		U	mg/L	0.02	0.1	7/10/98	gg

Metals Prep

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010 ICP						7/10/98	ms
Total Hot Plate Digestion	M3010 GFAA						7/7/98	laa
Total Hot Plate Digestion	M3010 ICP-MS						7/13/98	ms

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	M2320B							
Bicarbonate as CaCO3		163		mg/L	2	10	7/8/98	sts
Carbonate as CaCO3			U	mg/L	2	10	7/8/98	sts
Hydroxide as CaCO3			U	mg/L	2	10	7/8/98	sts
Total Alkalinity		163		mg/L	2	10	7/8/98	sts
Chloride	M325.2 - Colorimetric (RFA)	35		mg/L	1	5	7/8/98	mh
Conductivity @25C	M120.1 - Meter	3350		umhos/cm	1	10	7/8/98	sts
Fluoride	M340.2 - ISE	1.4		mg/L	0.1	0.5	7/9/98	bk
Lab Filtration	***						6/29/98	ms
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2	0.04	B	mg/L	0.02	0.1	7/20/98	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	0.04	B	mg/L	0.02	0.1	6/26/98	ss
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		U	mg/L	0.01	0.05	6/26/98	ss

Inorganic Qualifiers (based on EPA CLP 3/90):

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L19143-02***
Client Sample ID: *HER223*
Client Project ID:
ACZ Report ID: *RG72276*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *6/25/98 11:00*
Date Received: *6/26/98*
Date Reported: *7/20/98*

Sample Matrix: *Ground Water*

pH (lab)	M150.1 - Electrometric	7.4		units	0.1	0.1	7/8/98	sts
Phosphate	Calculation based on Ortho Phosphorus		U	mg/L	0.03	0.15	7/20/98	calc
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid		U	mg/L	0.005	0.03	6/26/98	ss
Residue, Filterable (TDS) @180C	M160.1 - Gravimetric	3520		mg/L	10	20	7/2/98	cj/cd
Sulfate	M375.3 - Gravimetric	2120		mg/L	10	20	7/9/98	bk

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

RVP

Vice President of Operations: Ralph Poulsen

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

ACZ Project ID: *L19143*
Client Project ID:
ACZ Report ID: *RG72739*

Date Sampled: *6/24/98*
Date Received: *6/26/98*
Date Reported: *7/23/98*

Radiochemistry

ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Preparation Method	Preparation Date	Preparation Analyst	Analysis Method	Analysis Date	Analysis Analyst
L19143-02	HER223	Ground Water	Gross Alpha	9	14	12	pCi/L	Method	7/17/98	jd	M9310	7/17/98	cbr
			Gross Beta	32	12	15	pCi/L	Method	7/17/98	jd	M9310	7/17/98	cbr
			Radium 228, total	1.8	1.3	2.6	pCi/L	Method	7/9/98	jd	M9320	7/14/98	cbr
			Thorium 230, total	0.46	0.3	0.2	pCi/L	Method	7/17/98	jd	ESM 4506	7/21/98	jd

Gross beta should not be higher than gross alpha

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

REPRC001.98.01.02

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

ACZ Project ID: L19578
Client Project ID:
ACZ Report ID: RG74211

Date Sampled: 6/24/98
Date Received: 7/28/98
Date Reported: 8/6/98

Why was this received on a different date than the rest of the sample?

Radiochemistry

ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Preparation Method	Preparation Date	Preparation Analyst	Analysis Method	Analysis Date	Analysis Analyst
L19578-02	HER223	Ground Water	Radium 226, total	10.99	0.87	0.57	pCi/L	Method	7/31/98	jd	M9315	7/31/98	cbr

Ra 266 is higher than the Gross Alpha

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

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Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L21309-01***
Client Sample ID: *HER228*
Client Project ID: *Hermit Mine*
ACZ Report ID: *RG83428*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *11/23/98 18:30*
Date Received: *11/25/98*
Date Reported: *12/21/98*

Sample Matrix: *Ground Water*

Metals Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Arsenic, total	M206.2 GFAA	0.002	B	mg/L	0.002	0.01	12/11/98	jb
Barium, total	M200.7 ICP	0.012	B	mg/L	0.006	0.02	12/11/98	kr
Cadmium, total	M213.2 GFAA		U	mg/L	0.0005	0.003	12/17/98	jb
Calcium, total	M200.7 ICP	552		mg/L	0.4	2	12/11/98	kr
Chromium, total	M218.2 GFAA		U	mg/L	0.001	0.005	12/12/98	jb
Copper, total	M220.2 GFAA		U	mg/L	0.001	0.005	12/12/98	jb
Iron, total	M200.7 ICP	19.30		mg/L	0.02	0.1	12/11/98	kr
Lead, total	M239.2 GFAA		U	mg/L	0.001	0.005	12/11/98	jb
Magnesium, total	M200.7 ICP	193		mg/L	0.4	2	12/11/98	kr
Manganese, total	M200.8 ICP-MS	0.341		mg/L	0.002	0.01	12/5/98	fep
Mercury, total	M245.1 CVAA		U	mg/L	0.0002	0.001	12/4/98	bg
Potassium, total	M200.7 ICP	21.0		mg/L	0.6	2	12/11/98	kr
Selenium, total	SM 3500-Se C, AA-Hydride		U	mg/L	0.001	0.005	12/3/98	bg
Silica, dissolved	M200.7 ICP	5.7		mg/L	0.4	1	12/11/98	gg
Silver, total	M272.2 GFAA		U	mg/L	0.0005	0.003	12/12/98	jb
Sodium, total	M200.7 ICP	76.6		mg/L	0.6	2	12/11/98	kr
Uranium, total	M200.8 ICP-MS	0.001	B	mg/L	0.001	0.005	12/8/98	fep
Zinc, total	M200.7 ICP		U	mg/L	0.02	0.1	12/11/98	kr

Metals Prep

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010 ICP						12/10/98	laa
Total Hot Plate Digestion	M3010 GFAA						12/11/98	bg
Total Hot Plate Digestion	M3010 ICP-MS						12/4/98	laa

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	M2320B							
Bicarbonate as CaCO3		118		mg/L	2	10	12/4/98	sts
Carbonate as CaCO3			U	mg/L	2	10	12/4/98	sts
Hydroxide as CaCO3			U	mg/L	2	10	12/4/98	sts
Total Alkalinity		118		mg/L	2	10	12/4/98	sts
Chloride	M325.2 - Colorimetric (RFA)	37		mg/L	1	5	12/11/98	jl
Conductivity @25C	M120.1 - Meter	3200		umhos/cm	1	10	12/4/98	sts
Fluoride	M340.2 - ISE	1.4		mg/L	0.1	0.5	11/28/98	cd
Lab Filtration	***						11/27/98	als

[illegible] (based on EPA/CLP 3/90)+ U

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L21309-01***
Client Sample ID: *HER228*
Client Project ID: *Hermit Mine*
ACZ Report ID: *RG83428*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *11/23/98 18:30*
Date Received: *11/25/98*
Date Reported: *12/21/98*

Sample Matrix: *Ground Water*

Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2	0.03	B	mg/L	0.02	0.1	12/21/98	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	0.03	B	mg/L	0.02	0.1	11/25/98	ss
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		U	mg/L	0.01	0.05	11/25/98	ss
pH (lab)	M150.1 - Electrometric	6.9		units	0.1	0.1	12/4/98	sts
Phosphate	Calculation based on Ortho Phosphorus		U	mg/L	0.03	0.15	12/21/98	calc
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	0.007	B	mg/L	0.005	0.03	12/3/98	ss
Residue, Filterable (TDS) @180C	M160.1 - Gravimetric	3290		mg/L	10	20	11/28/98	cd
Sulfate	M375.3 - Gravimetric	1900		mg/L	10	20	12/2/98	mh/cd

Note: Sample required re-analysis for Ortho Phosphorus after the applicable holdtime had expired. Retest value correlates with data from original analysis, performed within holdtime.

[illegible] (from EPA CLP 3/90):

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

RVP

Vice President of Operations: Ralph Poulsen

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

ACZ Project ID: *L21309*
Client Project ID: *Hermit Mine*
ACZ Report ID: *RG84329*

Date Sampled: *11/23/98*
Date Received: *11/25/98*
Date Reported: *1/4/99*

Radiochemistry

								Preparation			Analysis		
ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Method	Date	Analyst	Method	Date	Analyst
L21309-01	HER228	Ground Water	Gross Alpha	47	19	11	pCi/L	Method	12/10/98	cbr	M9310	12/11/98	cbr
			Gross Beta	49	13	15	pCi/L	Method	12/10/98	cbr	M9310	12/11/98	cbr
			Radium 226, total	4.78	0.87	1.2	pCi/L	Method	12/28/98	cbr	M9315	12/29/98	cbr
			Radium 228, total	3.09	0.84	1.7	pCi/L	Method	12/16/98	ejs	M9320	12/18/98	ejs
			Thorium 230, total	0.14	0.3	0.2	pCi/L	Method	12/11/98	jd	ESM 4506	12/17/98	jd

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

R Poulsen

Vice President of Operations: Ralph Poulsen

HERMIT MINE
WATER WELL MONITORING DATA
4th Quarter 1990 to Present

Quarterly Sampling

Parameters	HER073 Collected 10/24/90	HER094 Collected 3/28/91	HER100 Collected 4/30/91	HER112 Collected 9/20/91	HER114 Collected 12/19/91	HER120 Collected 3/26/92	HER122 Collected 6/26/92	HER126 Collected 9/22/92
	4th-1990	1st-1991	2nd-1991	3rd-1991	4th-1991	1st-1992	2nd-1992	3rd-1992
Silver	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.002	0.002	<0.001	0.006	<0.001	0.002	0.003	<0.001
Barium	0.01	0.01	0.01	0.02	0.01	0.04	<0.01	0.01
Calcium	525	513	579	658	571	566	587	524
Cadmium	<0.005	<0.005	0.009	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	<0.01	<0.01	0.01	0.02	0.03	0.03	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	0.01	0.02	0.03	<0.01	<0.01
Iron	9.47	6.41	7.07	9.3	6.61	6.10	5.64	5.40
Lead	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Magnesium	177	161	191	218	184	191	199	204
Manganese	0.12	0.09	0.09	0.12	0.09	0.1	0.07	0.06
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002
Potassium	20.1	20.7	21.7	25.0	20.2	21.3	21.4	21.7
Selenium	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium	78.1	68.6	75.1	91.0	73.3	75.5	78.6	79.1
Zinc	0.111	<0.005	<0.005	<0.005	0.005	0.052	0.176	0.038
Fluoride	1.5	1.6	1.5	<0.1	0.5	0.9	1.6	3.1
Alkalinity	161	154	162	177	173	168	159	160
HCO3	161	154	162	177	173	168	159	160
CO3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride	40	41	40	72	38	40.0	35.0	41.0
pH	7.38	6.84	7.56	7.09	6.95	7.89	7.37	6.98
Specific Conductance (a)	3470	2440	2580	3140	4140	3060	1500	3700
TDS	3380	3250	3360	3280	3760	3410	3410	3330
NO3 as N	<0.1	<0.1	<0.1	0.2	0.9	<0.1	0.2	<0.1
Phosphate	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate	1830	2290	2270	1860	2290	2200	2100	2280
Silica	13.0	12.6	12.7	14.0	13.4	17.0	5.4	6.13
Gross Alpha (b)	58±26	71±31	10±19	27±21	12±18	9±20	24±16	24±22
Gross Beta (b)	48±14	27±15	15±14	24±13	37±13	44±15	32±14	34±12
Ra 226 (b)	3.2±0.6	2.4±0.5	3.5±0.7	2.8±0.6	1.9±0.5	8.9±1.7	3.1±0.9	10±2
Th 230 (b)	0.0±0.5	0.0±0.4	0.0±0.5	0.0±0.5	0.0±0.5	0.0±0.5	0.0±0.5	0.0±1.0
Uranium	0.0009	0.0027	0.0016	<0.0003	0.0019	0.0008	0.0004	0.0005

LEGEND

Units in mg/l unless noted
(a)units in micro Mhos/cm
(b)units reported in picocuries/l
DL - Detection Limit
BDL - Below Detection Limit
MGL - Maximum Groundwater Limit

Barringer did not use an ICP-MS and could not have measured U concentrations this low.

HERMIT MINE
WATER WELL MONITORING DATA
4th Quarter 1990 to Present

	Quarterly Sampling			Bi-Annual Sampling			
Parameters	HER129 Collected 12/10/92	HER134 Collected 3/3/93	HER 137 Collected 6/16/93	HER148 Collected 2/16/93	HER150 Collected 3/03/94	HER167 Collected 12/09/94	HER176 Collected 06/21/95
	4th-1992	1st-1993	2nd-1993	2nd-1993	1st-1994	2nd-1994	1st-1995
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.003	0.005	<0.001	<0.001	0.002	0.003	<0.003
Barium	0.01	0.01	0.01	0.01	0.01	<0.02	<0.02
Calcium	618	600	652	628	623	660	592
Cadmium	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	4.83	4.62	4.77	4.27	4.24	4.30	4.10
Lead	0.03	<0.02	<0.02	<0.02	<0.02	0.005	0.005
Magnesium	208	200	208	212	201	205	197
Manganese	0.05	0.05	0.06	0.05	0.05	0.055	0.046
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Potassium	23.9	22.8	23.4	24.0	21.1	23.0	22.0
Selenium	0.032	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005
Sodium	84.4	79.7	83.0	86.2	78.7	83.0	79.0
Zinc	<0.005	<0.005	<0.005	<0.005	<0.005	<0.02	<0.02
Fluoride	1.5	2.1	2.8	3.0	2.8	3.2	1.1
Alkalinity	158	152	162	160	163	159	172
HCO3	158	152	162	160	163	159	172
CO3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride	37.0	38.0	37.0	38.0	37.0	39.0	35.0
pH	6.87	6.90	6.93	7.02	7.00	7.06	7.25
Specific Conductance (a)	3520	3040	2030	3330	3434	3270	3420
TDS	3410	2790	3450	3320	3250	3240	3200
NO3 as N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2
Phosphate	<0.1	<0.02	<0.1	<0.1	<0.1	<0.02	<0.05
Sulfate	2130	1960	2280	2200	2290	2240	2180
Silica	6.17	6.23	6.12	6.5	6.3	13.0	13.0
Gross Alpha (b)	46±29	23±22	34±25	51±20	15±13	11±17	53±25
Gross Beta (b)	48±13	27±14	58±26	46±14	21±14	12±12	60±20
Ra 226 (b)	5.8±1.3	9.0±1.5	9.3±2.1	10±2	8.9±1.3	7.4±0.8	10±1
Th 230 (b)	1.6±0.8	0.4±0.6	0.2±0.8	0.4±0.7	0.5±0.7	0.4±0.3	0.6±0.6
Uranium	0.0005	0.0006	0.0022	0.0003	<0.0003	0.0019	0.0007

LEGEND

Units in mg/l unless noted
(a)units in micro Mhos/cm
(b)units reported in picocuries/l
DL - Detection Limit
BDL - Below Detection Limit
MGL - Maximum Groundwat

How does gross alpha increase but U concentrations decrease?

HERMIT MINE
WATER WELL MONITORING DATA
4th Quarter 1990 to Present

Bi-Annual Sampling

Parameters	HER183 Collected 11/14/95	HER189 Collected 05/15/96	HER192 Collected 07/31/96	HER208 Collected 06/18/97	HER218 Collected 12/30/97	HER223 Collected 06/25/98
	2nd-1995	1st-1996	2nd-1996	1st-1997	2nd-1997	1st-1998
Silver	<0.01	<0.01	<0.01	<0.01	<0.0005	<0.0005
Arsenic	<0.003	<0.003	<0.003	0.005	0.001	0.002
Barium	<0.02	<0.02	<0.02	<0.02	<0.02	0.013
Calcium	652	617	604	585	596	561
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001
Copper	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001
Iron	4.50	4.70	4.00	2.10	2.51	5.91
Lead	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Magnesium	217	208	202	199	194	190
Manganese	0.055	0.046	0.044	0.040	0.050	0.084
Mercury	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002
Potassium	22.0	21.0	22.0	21.0	20.0	20.6
Selenium	<0.005	<0.005	<0.005	<0.005	<0.01	<0.001
Sodium	87.0	76.0	81.0	82.0	75.0	74.2
Zinc	<0.02	<0.02	<0.02	<0.02	0.002	<0.02
Fluoride	1.7	1.6	1.7	1.5	1.5	1.4
Alkalinity	164	165	160	160	166	163
HCO3	164	165	160	160	166	163
CO3	<5.0	<1.0	<1.0	<1.0	<2.0	<2.0
Chloride	36.0	38.0	36.0	37.0	35.0	35.0
pH	7.07	7.84	7.20	7.85	7.00	7.40
Specific Conductance (a)	3410	3380	3370	3100	3250	3350
TDS	3220	3360	3340	3320	3220	3520
NO3 as N	<0.1	<0.1	0.1	<0.01	0.02	0.04
Phosphate	<0.05	<0.02	<0.02	<0.05	<0.005	<0.005
Sulfate	2280	2500	2240	2340	2180	2120
Silica	14.0	14.0	14.0	14.0	13.0	12.5
Gross Alpha (b)	15±17	35±21	18±18	36±26	13±13	9±14
Gross Beta (b)	44±17	30±25	5±31	8±47	32±13	32±12
Ra 226 (b)	7.3±0.8	4.3±0.7	7.5±0.8	9.5±1.2	11.1±1	11.0±.87
Th 230 (b)	0.0±0.1	0.0±0.4	0.0±0.4	0.2±0.4	0.2±0.1	0.46±0.3
Uranium	<0.0003	0.0018	0.0011	<0.0009	0.0007	<0.0005

?

LEGEND

Units in mg/l unless noted
(a)units in micro Mhos/cm
(b)units reported in picocuries/l
DL - Detection Limit
BDL - Below Detection Limit
MGL - Maximum Groundwat

HERMIT MINE
WATER WELL MONITORING DATA
4th Quarter 1990 to Present

Parameters	HER228 Collected 11/23/98	STATISTICAL SUMMARY DATA RANGE MIN - MAX	AVERAGE	MGL	
	2nd-1998				
Silver	<0.0005	BDL - 0.01	BDL	0.03	
Arsenic	0.002	BDL - .006	0.0025	0.024	
Barium	0.012	BDL - 0.04	0.0152	0.06	
Calcium	552	513 - 660	594	630	
Cadmium	<0.0005	BDL - .009	0.0053	0.027	
Chromium	<0.001	BDL - 0.03	0.011	0.21	
Copper	<0.001	BDL - 0.03	0.01	0.04	
Iron	19.3	2.10 - 19.3	5.92	11.21	
Lead	<0.001	BDL - 0.03	0.0132	0.16	
Magnesium	193	161 - 218	198	199	
Manganese	0.341	.010 - .341	0.080	0.19	
Mercury	<0.0002	BDL - .0002	BDL	0.002	
Potassium	21.0	20.0 - 25.0	21.8	28.7	
Selenium	<0.001	BDL - .032	0.004	0.043	
Sodium	76.6	68.6 - 91.0	79.3	85.7	
Zinc	<0.02	BDL	0.0265	0.189	
Fluoride	1.4	0.1 - 3.2	1.7	1.53	
Alkalinity	118	118 - 177	160.7	161	
HCO3	118	118 - 177	160.7	161	
CO3	<2.0	BDL	BDL	0	
Chloride	37.0	35.0 - 72.0	39.2	44.0	
pH	6.90	6.84 - 7.89	7.20	6.85	
Specific Conductance (a)	3200	1500 - 4140	3142	3555	
TDS	3290	2790 - 3760	3323	3615	
NO3 as N	0.03	BDL - 0.9	0.05	0.8	
Phosphate	0.007	BDL - .007	0.065	0	
Sulfate	1900	1830 - 2500	2180	2425	
Silica	5.7	5.4 - 17.0	10.9	14.3	
Gross Alpha (b)	47±19	9±14 - 71±31	29.14	84	20 pCi/L
Gross Beta (b)	49±13	5±31 - 60±20	33.32	43	
Ra 226 (b)	4.8±.87	4.3±0.7 - 11.1±1	6.9	4.4	
Th 230 (b)	0.14±0.3	0.0±0.1 - 1.6±0.8	0.23	1.0	
Uranium	0.001	BDL - .0027	0.001	0.003	EPA MCL: 0.030 mg/L

LEGEND

Units in mg/l unless noted
(a)units in micro Mhos/cm
(b)units reported in picocuries/l
DL - Detection Limit
BDL - Below Detection Limit
MGL - Maximum Groundwat

MEMORANDUM

TO: Rober A. Hembree, Mine Planning Engineer

FROM: John F. Beesley, Jr. Mine Engineer

SUBJECT: Hermit Pond Liner Installation

DATE: September 3, 1987

Installation of the pond liner at Hermit began August 12, 1987 with preparation of the pond bottom surfaces. The bottom and sides were rolled with a double drum, self-propelled, vibrating compactor. They were then inspected and any protruding rocks and twigs were removed. Preparation of the liner surface took 2 men 2 weeks to complete. Care was taken to ensure a smooth, competent bed for the liner. An anchor trench 1 foot deep and 18 inches wide was also cut during preparation for anchoring the liner.

A high density, chlorosulfonated polyethylene, Hypalon liner, 36 mils thick, was laid down on August 18 and 19. We used 10 workers both days to spread the liner. Four panels, 57.75 feet by 200 feet, were spread for a total of 46,200 square feet of liner. Three field seams, each 200 feet long, were seamed using trichloroethane prewipe and Hypalon to Hypalon bonding cement. Seaming was done under the direct supervision of myself to ensure that procedures were meticulously followed, ie., proper cleaning of surface, application of prewipe, even spreading of glue, liner laying flat with no wrinkles, surfaces pressed together and rolled flat. Seaming was not attempted when temperatures were lower than 75 degrees.

All seams were checked with a 90 psi air lance. All bubbles, leaks and weak spots were patched and rechecked. The maximum depth of the pond is 10 feet, the airlance pressure corresponds to over 200 feet of water so seams are guaranteed to be water tight. All factory seams were also air lanced. As field engineer, I personally airlanced every foot of field seams. All field seams were checked at least three times and some even four times. Confidence that the liner is watertight is very high.

The liner was installed following specifications outlined by the Hypalon manufacturer. We also complied with all other requirements as outlined in the mine plan. Volume of the pond has been calculated and is 6.5 acre feet. 6.5 acre feet is just for one of the two ponds

Telephone Conversation Log

By: Craig DeWalt C.D.	Date: 1/14/99	Time: 11:00a.m – 11:40a.m.	
Name: Donn Pillmore		Phone: (520) 643-7321	
Of: IUSA		Fax:	
Re: Hermit Mine Clean Closure			

Record of conversation:

I called him to discuss issues and to request additional information to proceed with clean closure.

1.) Requested information regarding difference in DWR registration number listed in NOD for the water supply well, 55-517832, and what is listed in the GWQPP and subsequent reports as 55-518877. He will investigate.

2.) Requested any information on well construction and depth. He will send drawings if found.

3.) Requested latitude and longitude of monitoring well. I explained that for clean closure, a POC needed to be designated. I also explained that for clean closure, no post closure monitoring could be required. To accomplish this, I explained that I needed info from them summarizing the post-mining monitoring results, indicating no significant difference in contaminant levels and no indication that the mining activity caused exceedances in GPL's or AWQS. He will investigate.

4.) Requested follow-up information regarding their notification to ADEQ Compliance in letter from EFN 3/8/95 regarding apparent exceedances. He will investigate.

5.) Requested that they provide any and all information regarding the pond construction, including drawings, as well as any information they can provide about the condition of the liner at closure and removal. He will provide.

6.) Materials from Ore pad were removed and sent for uranium recovery or filled in shaft.

Notes:

7.) Requested they provide copies of all SMRF's laboratory results so that we may have them on file. Only the SMRF's we sent to them (Compliance) are on file with numbers input from forms. They will send.

Mr. Pillmore informed me that they could not find the radiometric survey map they intended to send. They have resurveyed & will send. As well as pictures of the reclaimed site.

C.D. 1/14/99

1/11/99

IVC Hermit Mine Closure

* Is there any information regarding the condition of the pond liner at closure? As constructed drawings?

* What happened with the ore pad? - As constructed drawings? BADCT

Also Minnesota Water 2/23/90 Pre-Existing Expert Mine Config. Plate? - including (2) water evaporation ponds.

** Why is it listed in the GWQPP that there is a 12.6 acre-foot lined impoundment, but on Exhibit 4 of Canonie Report "Potential Impacts of Mining on GW Resources" Hermit surface layout by ADM for D. Pillmore showing 2 ponds - 6.5 Acre-ft. - 6.6 Acre-ft. as a 9/8/89

Reg. 1&2 Lined Evaporation Ponds?

* Mining Depth? 1,130 feet

Depth to Groundwater? - The SMRF's show 1,498 ft. prior to pumping. Pump intake 448 ft. below water surface

500 year 24-hour storm

* Provide actual laboratory reports for SMRF's. Semi-annually required during post-mining. Please provide (1) 97 second semi annual report. (2) 1998 1st semi-annual pending Total Radium 226 (3) 1998 2nd semi annual.

Post-mining monitoring programs.

(4) Any additional info regarding the 3/8/95 letter informing ADEQ of a February 3, 1995 notification concerning the "initial outline" to address water quality data related to the monitoring well. Response to indication of apparent exceedences of parameters described within GWQPP.

Exec. Summ. 1.2. * Surface facilities were situated at an elevation of ~? feet over the groundwaters of Redwall-Muav Kaibab Plateau - Deepest mine workings extended ~? feet below ground surface. Approx ? feet above the regional aquifer. 1,100' - 1,130' Facility as (4,886) Actual 4,900 ?

X * Info on GPL's & Alert levels? who established? Do they have copy from us?

X * Latitude & Longitude of POC

X * Where did Well# come from? May have been given different # - May be 2 numbers. Well Depth: Well Construct data

Monitoring Well

RECEIVED
MAR 1 0 1995
SURFACE WATER
ENFORCEMENT UNIT

energy fuels nuclear, inc.

2555 N. Hwy 89A
HC 64, Box 152
Fredonia, Arizona 86022

Exploration - (602) 643-7325
Operations - (602) 643-7321
Fax Number- (602) 643-7328

March 8, 1995

CERTIFIED MAIL
NO: Z 051 151 575

AQUIFER PROTECTION
PROGRAM SECTION

MAR 1 3 1995

RECEIVED

Arizona Department of Environmental Quality
Office of Water Quality
Surface Water Enforcement Unit - 5th Floor
3033 North Central Avenue
Phoenix, Arizona 85012

Dear Sir:

Re: Arizona Groundwater Permit -- Hermit Mine -- Post Closure Monitoring Permit No. G-0035-08

This letter is written following the Energy Fuels Nuclear, Inc. (EFNI), February 3, 1995, notification to the Arizona Department of Environmental Quality (ADEQ), concerning the initial outline to address water quality data related to the EFNI Hermit Mine Groundwater Monitoring Well.

Delayed receipt of water quality and laboratory reports and related computer statistical analyses thereof has slowed progress to respond to indication of apparent exceedances of parameters described within Groundwater Protection Permit No. G-0035-08. Work towards completing the initial step to address the quality assurance of existing data as described in the correspondence of February 3, 1995, is ongoing and progress of this effort will continue to be reported to ADEQ monthly. Upon completing the data statistical analyses report, geochemical issues will be investigated as may be required.

Should additional information concerning the work schedule addressing the apparent Hermit Mine Groundwater Monitoring Well apparent exceedances be required, do not hesitate to contact me at the EFNI Fredonia, Arizona, office telephone number: (602) 643-7321 or via fax number: (602) 643-7328.

Very truly yours,

Roger B. Smith
General Manager of Mining Operations

RBS/ksc

cc: Mr. Harold R. Roberts
Mr. Lawrence L. Casebolt
Ms. Michelle R. Rehmann

INTERNATIONAL
URANIUM (USA)
CORPORATION

2555 N. Highway 89A ♦ H.C. 64 Box 153 ♦ Fredonia AZ 86022 ♦ 520 643-7321 ♦ 520 643 7328 (fax)

FACSIMILE TRANSMITTAL

TO:	Craig DeWalt	**FAX NO:**	602-207-4674
	ADEQ	**PHONE NO:**	602-207-4789
FROM:	Donna Pillmore	**DATE:**	1/4/99
		PAGE 1 OF:	2
		IF ALL PAGES ARE NOT RECEIVED, PLEASE CALL:	Donna
		PHONE NO:	520-643-7321

IMPORTANT/CONFIDENTIAL: FAX messages are sometimes received by persons other than to the person to whom they are addressed as a result of equipment failure or human error. This Communication is intended solely for the addressee shown above. Please notify our office immediately at any of the telephone or Fax numbers shown above if you are not the addressee or someone responsible for delivering it to the addressee. We retain all rights and privileges as to this communication and prohibit any dissemination, distribution or copying by or to anyone other than the addressee Our office will arrange for its return by the United States Postal Service or by commercial carrier to us at no cost to you.

HERMIT MINE RECLAMATION

DATE	DESCRIPTION
September, 1990	All surface plant facilities removed
September, 1990	Main shaft backfilled and sealed
August, 1994	Ore stockpiles were transported to the White Mesa Mill
August, 1994	Surface containment pond hypalon liner removed (salvaged)
August, 1994	Sediment/precipitant accumulated in the pond was collected as ore and sent to the White Mesa Mill
August, 1994	Ventilation Shaft backfilled and sealed
September, 1994	Security Fence Removed
September, 1994	Concrete sewage septic system tanks removed
September, 1994	Cattle guards removed from the haulage road
November, 1994	Radiological site survey was completed
November, 1994	Re-contouring of the Hermit Mine site and spreading of topsoil
December, 1994	Site reclamation completed

IUC INTERNATIONAL URANIUM (USA) CORPORATION

WATER PERMITS
JAN 15 1999
RECEIVED

H.C. 64 • Box 153 • 2555 No. Highway 89A • Fredonia, AZ 86022 • 520 643 7321 (phone) • 520 643 7328 (fax)

January 13, 1999

VIA UPS
Mr. Craig DeWalt, REM
Arizona Department of Environmental Quality
3033 North Central Avenue, M0401A
Phoenix, Arizona 85012

Re: Radiological Survey Map and Photographs of the Hermit Mine Site

Dear Craig,

Per your request, enclosed is the radiological survey map and photographs of the Hermit Mine Site. The original radiological survey map that was prepared in November, 1994, when the first survey was conducted, could not be located; consequently, a new radiological survey had to be conducted and the enclosed map was compiled based on radiological survey data collected on January 7, 1999. Two copies of the survey map are enclosed.

There are five photographs enclosed that present a photographic history of the Hermit Mine Site. The first photograph shows the mine site when the Hermit Mine was in operation and at full production. The second photograph shows the Hermit Mine Site when all of the buildings, equipment, headframe, and other structures had been removed from the site and all that was left were the evaporation ponds, ore stockpiles, and the well and water storage tank, taken in April, 1993. The third photograph is a picture of the mine yard during reclamation, and the replacement of the topsoil over the mine site, taken in November, 1994. The fourth photograph was taken last week when the radiological survey was conducted, on January 7, 1999. This photograph shows what the mine site looks like today after being reclaimed. The fifth photograph is a picture of the radiological survey being conducted on January 7, 1999. This picture is taken in about the center of the original mine site.

After reviewing the enclosures should you have any questions or require additional information please feel free to call Mr. Roger Smith, General Manager of Mining Operations or me at 520-643-7321.

Very truly yours,

Donn M. Pillmore

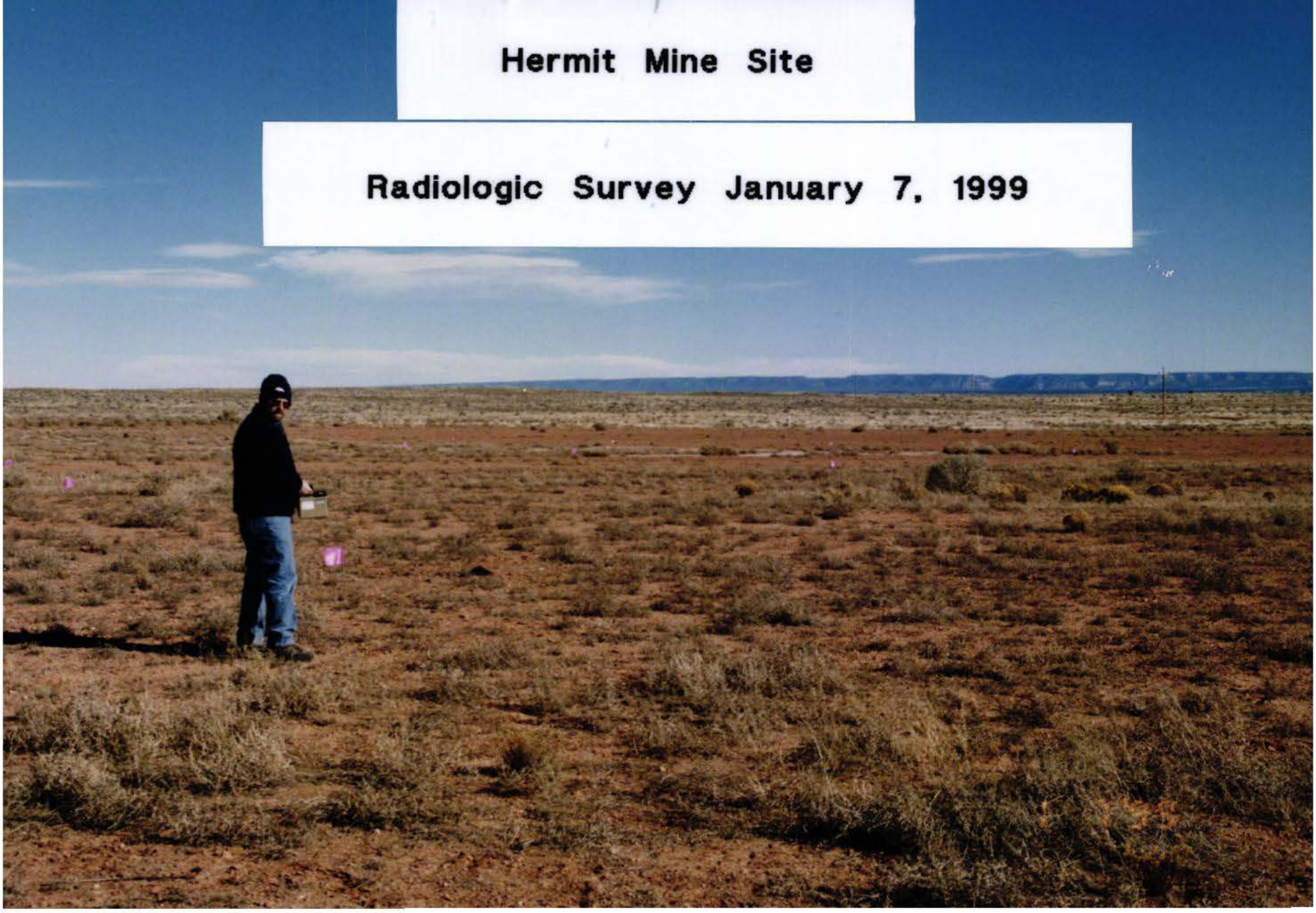
Donn M. Pillmore
Project Manager

Enclosures

cc: Dennis L. Turner/ADEQ
Jayanta Das/ADEQ
R. B. Smith

HERMIT MINE RECLAMATION

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Hermit Mine Site
Radiologic Survey January 7, 1999



Hermit Mine Site

Looking Northeast January 7, 1999

Hermit Mine Site

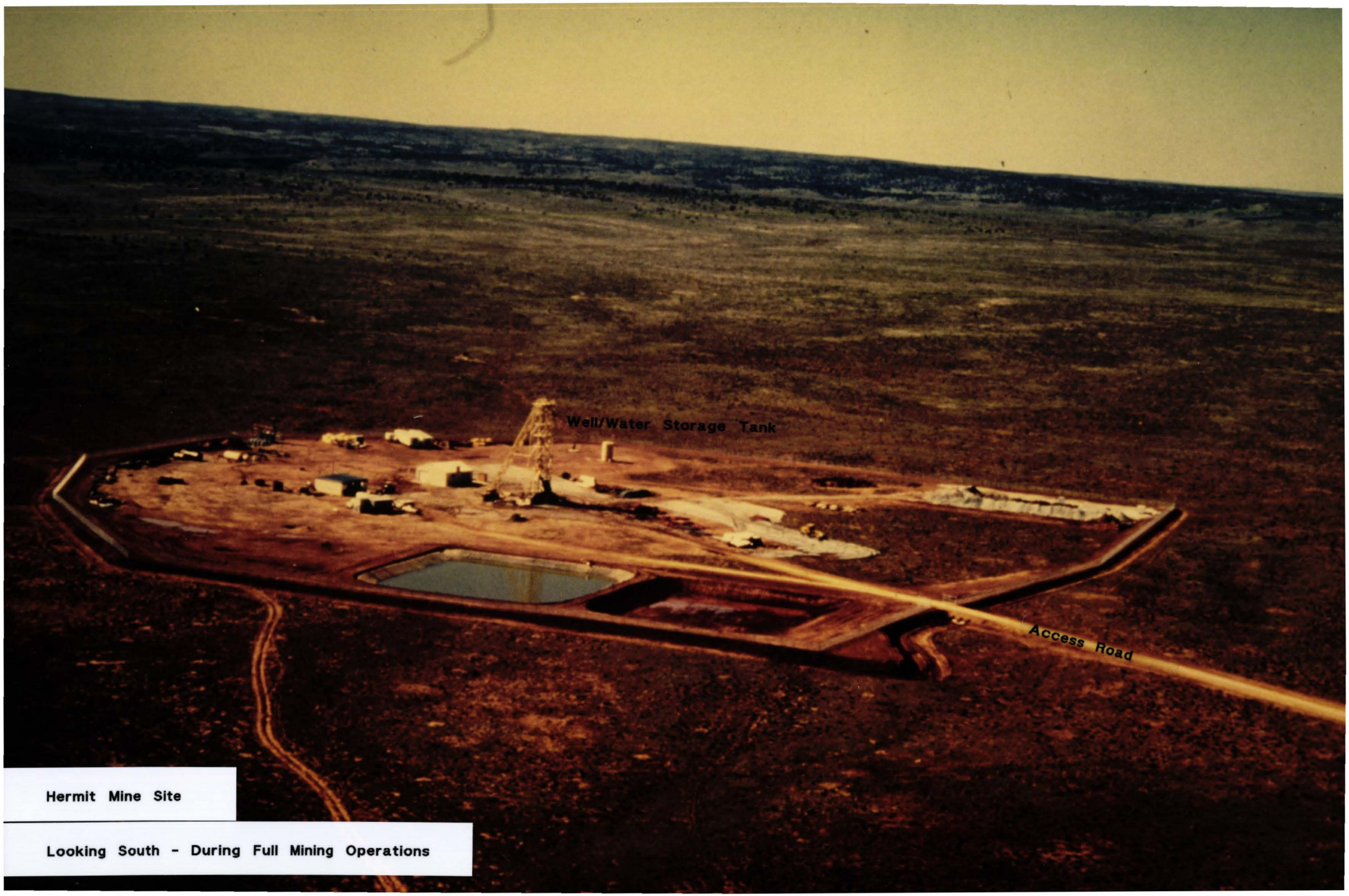
Looking South - November, 1994

Replacing Topsoil and Final Grading





Hermit Mine Site - Looking Northeast - April 29, 1993



Hermit Mine Site

Looking South - During Full Mining Operations

Mine Access Road

18
o Grid Point
w/ micro R/HR Reading

Scale 1 inch = 50 feet

WATER PERMITS
JAN 15 1999
RECEIVED

HERMIT MINE SITE

Radiological Survey Map

January 8, 1999

Mine Access Road

18
O Grid Point
w/ micro R/HR Reading

N

Scale 1 inch = 50 feet

WATER PERMITS
JAN 15 1999
RECEIVED

HERMIT MINE SITE

Radiological Survey Map

January 8, 1999

File Divider Page

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

REVIEW OF SHAFT AND RAISE CLOSURE PLAN AT THE HERMIT MINE OF ENERGY FUELS NUCLEAR, INC.

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

FEBRUARY, 1990

BEHRE DOLBEAR & COMPANY, INC.
1601 BLAKE STREET, SUITE 510
DENVER, COLORADO 80202
(303) 620-0020



PROJECT NO. D-0137

REVIEW OF SHAFT AND RAISE CLOSURE PLAN AT THE HERMIT MINE OF ENERGY FUELS NUCLEAR, INC.

INTRODUCTION

The Hermit Mine of Energy Fuels Nuclear, Inc. (EFNI), located in Section 17, T38N, R4W, Mohave County Arizona, is being closed because of depleted reserves. Part of Groundwater Quality Protection Permit No. G-0035-08 for the Hermit Mine reads as follows:

> "Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of a clay plug, a 40% clay/60% crushed shale plug or a bentonite plug in the main shaft, the air shaft and the monitoring well."

At the request of EFNI, a Behre Dolbear mining engineer visited the EFNI offices in Fredonia, Arizona on February 12, 1990 to review those portions of the EFNI mine closure plan relating to water containment and mine access. After a thorough review and discussions with members of the EFNI staff, a trip was made to the Hermit Mine to examine the locations where EFNI is proposing to place various plugs, a bulkhead, and fill material.

The person who made the examination was Richard Waissar, a mining engineer with 29 years of experience and a registered professional engineer in Colorado. Mr. Waissar is familiar with the geology and ground conditions in the area, having previously provided consulting services for parties other than EFNI at the Hack Canyon, Pigeon, and Kanab North Mines, which are in the same geologic environment.

PLAN DESCRIPTION

The EFNI closure plan is depicted in Figure 1. During the site visit it was observed that water was flowing from the Toroweap

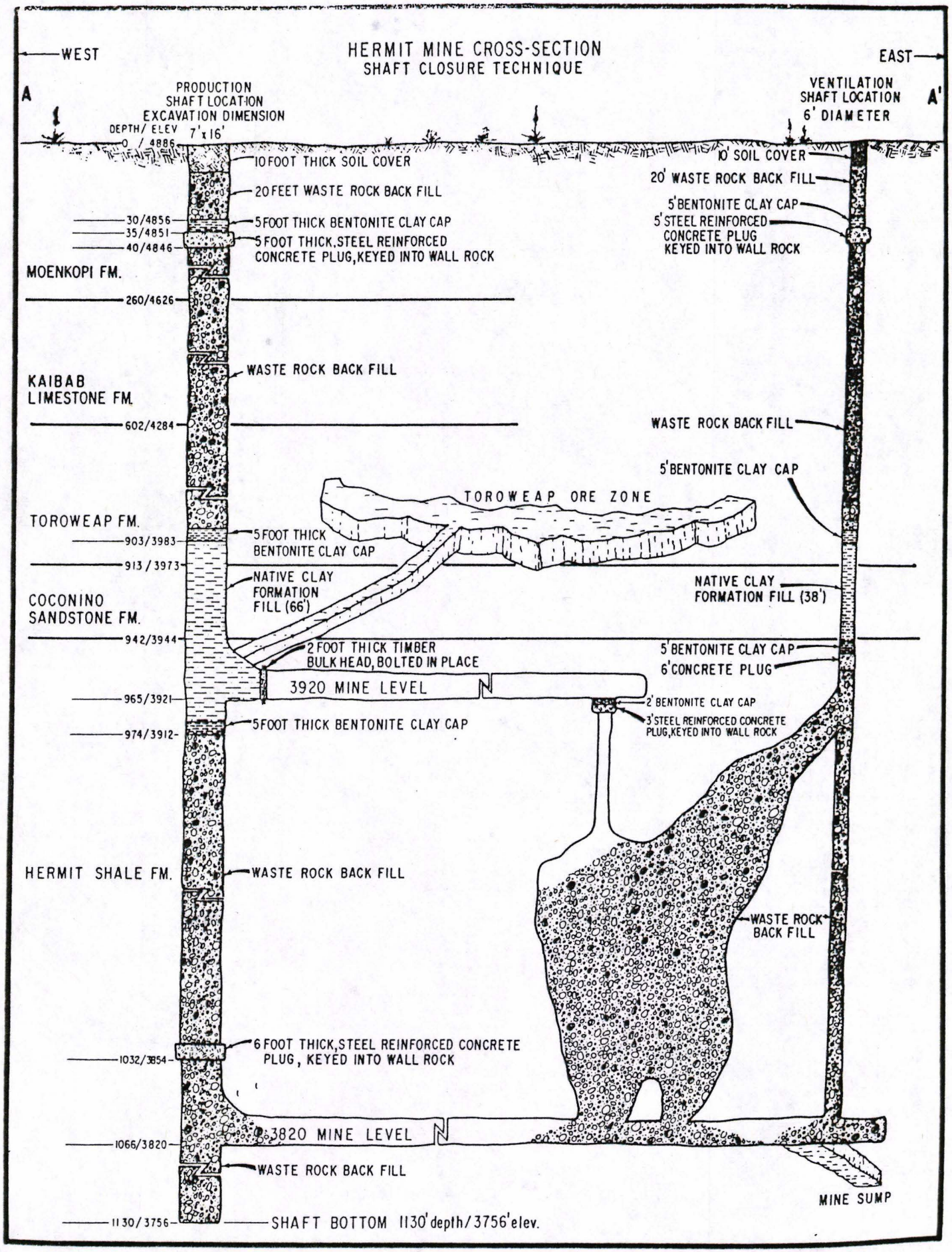

HERMIT MINE CROSS-SECTION
SHAFT CLOSURE TECHNIQUE
WEST
EAST
A
A'
PRODUCTION SHAFT LOCATION EXCAVATION DIMENSION 7'x16'
DEPTH/ ELEV 0 / 4886
VENTILATION SHAFT LOCATION 6' DIAMETER
10 FOOT THICK SOIL COVER
10' SOIL COVER
20 FEET WASTE ROCK BACK FILL
20' WASTE ROCK BACK FILL
5' BENTONITE CLAY CAP
5' STEEL REINFORCED CONCRETE PLUG KEYED INTO WALL ROCK
30/4856
35/4851
40/4846
5 FOOT THICK BENTONITE CLAY CAP
5 FOOT THICK, STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
MOENKOPI FM.
260/4626
WASTE ROCK BACK FILL
KAIBAB LIMESTONE FM.
602/4284
WASTE ROCK BACK FILL
5' BENTONITE CLAY CAP
TOROWEAP ORE ZONE
TOROWEAP FM.
903/3983
5 FOOT THICK BENTONITE CLAY CAP
913/3973
NATIVE CLAY FORMATION FILL (66')
NATIVE CLAY FORMATION FILL (38')
COCONINO SANDSTONE FM.
942/3944
2 FOOT THICK TIMBER BULK HEAD, BOLTED IN PLACE
5' BENTONITE CLAY CAP
6' CONCRETE PLUG
3920 MINE LEVEL
965/3921
2' BENTONITE CLAY CAP
3' STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
974/3912
5 FOOT THICK BENTONITE CLAY CAP
HERMIT SHALE FM.
WASTE ROCK BACK FILL
WASTE ROCK BACK FILL
1032/3854
6 FOOT THICK, STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
3820 MINE LEVEL
1066/3820
WASTE ROCK BACK FILL
MINE SUMP
1130/3756
SHAFT BOTTOM 1130' depth/3756' elev.

FIGURE 1

ore zone down the incline and into the production shaft at a rate estimated to be 15-20 gallons per minute. The objective of the EFNI plan is to isolate this flow and flows from the Coconino Sandstone, which underlies the Toroweap formation, from lower geologic units. The next lower known aquifer is located in the Muav limestone which is separated from the Coconino sandstone by 1800 feet of other sedimentary rocks. Of particular interest is the Hermit shale, a relatively tight, impermeable shale approximately 30 feet below the Toroweap formation and about 1800 feet above the Muav limestone. Klinkenberg permeability tests performed on core samples of the Hermit shale taken at the mine showed an estimated vertical permeability below the detection level of the equipment, or at least 10^{-11} cm/sec. The bottom of the production shaft and the mine sump are in this shale. The various geologic structures are shown in Figure 2.

R/M aquifer is in Surprise Canyon Formation, not Muav

At Kanab North perched aquifer in Supai and at Hack in Hermit - so Hermit is permeable at least in some areas

Referring once again to Figure 1, the sequence of the EFNI plan is as follows:

1. Drill and blast keyway excavation in production shaft at 3854 elevation.
2. Fill shaft with waste rock to 3854 elevation.
3. Pour 6-foot steel-reinforced concrete plug at key location.
4. After concrete plug cures sufficiently, fill shaft with waste rock backfill to 3912 elevation.
5. Place a 5-foot layer of bentonite at 3912 elevation.
6. Widen mouth of raise at end of 3920 level.
7. Pour 3-foot thick, steel-reinforced concrete plug beginning 5 feet below mouth of raise.
8. Place 2-foot thick layer of bentonite on top of concrete raise plug.
9. Construct 2-foot thick timber bulkhead in 3920 level to seal off shaft from level.

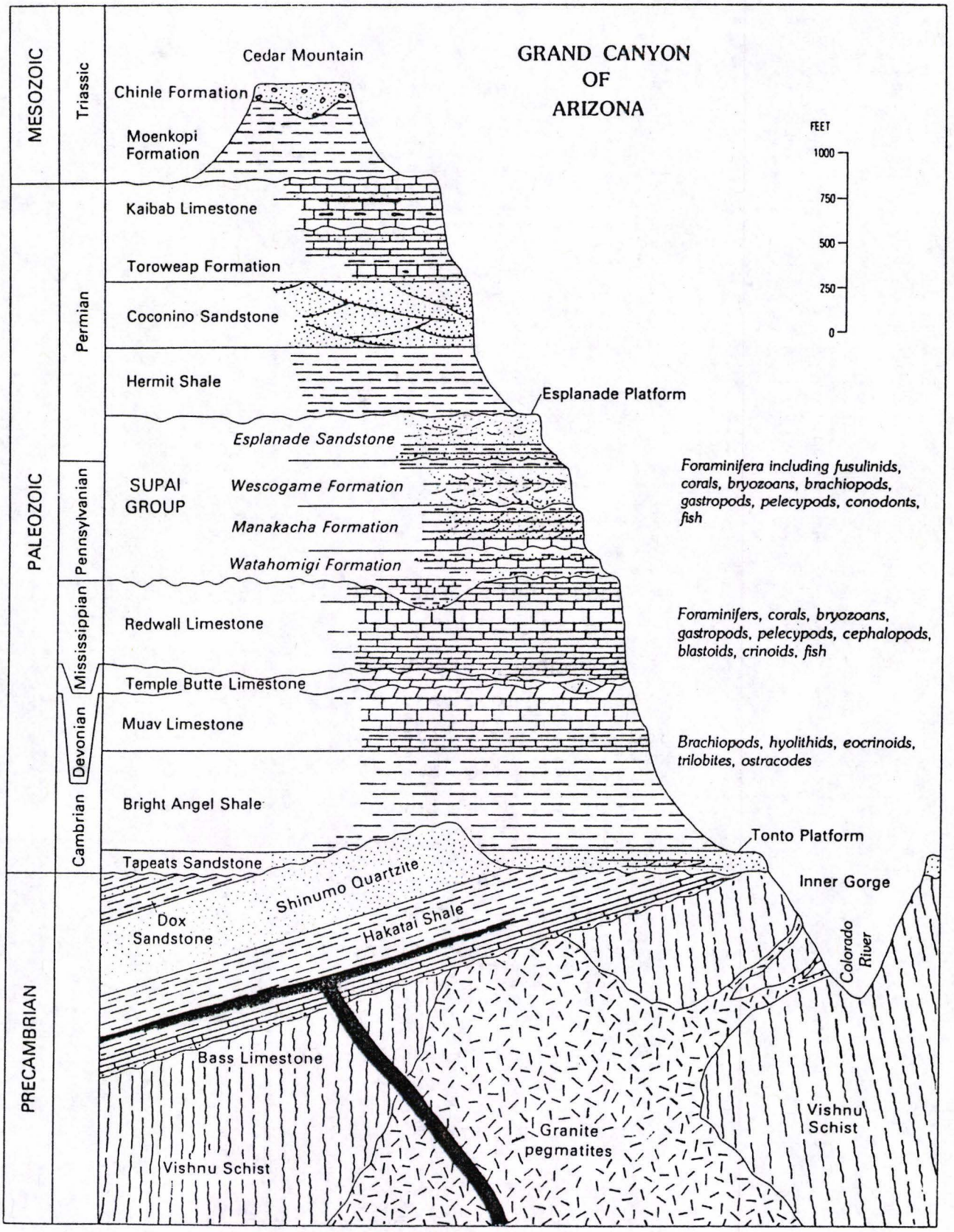

GRAND CANYON
OF
ARIZONA
MESOZOIC
PALEOZOIC
PRECAMBRIAN
Triassic
Permian
Pennsylvanian
Mississippian
Devonian
Cambrian
Cedar Mountain
Chinle Formation
Moenkopi Formation
Kaibab Limestone
Toroweap Formation
Coconino Sandstone
Hermit Shale
Esplanade Platform
Esplanade Sandstone
SUPAI GROUP
Wescogame Formation
Manakacha Formation
Watahomigi Formation
Redwall Limestone
Temple Butte Limestone
Muav Limestone
Bright Angel Shale
Tapeats Sandstone
Shinumo Quartzite
Dox Sandstone
Hakatai Shale
Bass Limestone
Vishnu Schist
Granite pegmatites
Vishnu Schist
Tonto Platform
Inner Gorge
Colorado River
FEET
1000
750
500
250
0
Foraminifera including fusulinids, corals, bryozoans, brachiopods, gastropods, pelecypods, conodonts, fish
Foraminifers, corals, bryozoans, gastropods, pelecypods, cephalopods, blastoids, crinoids, fish
Brachiopods, hyolithids, eocrinoids, trilobites, ostracodes

FIGURE 2

10. Backfill shaft and portion of shaft station at 3920 level with Moenkopi derived soil obtained from surface excavations (called "native clay formation fill" in Figure 1).
11. Place 5-foot thick bentonite clay cap on top of Moenkopi material at 3983 elevation.
12. Fill shaft to 4846 elevation with waste rock.
13. Drill and blast 5-foot keyway at 4846 elevation.
14. Pour 5-foot thick, steel-reinforced concrete plug at 4846 elevation. NOTE: The purpose of this plug is to prevent surface subsidence and to assist in the prevention of surface water inflows.
15. Place 5-foot thick bentonite plug on top of concrete plug.
16. Fill shaft to within 10 feet of surface with waste rock.
17. Fill remaining portion of production shaft with surface soil.
18. Fill ventilation shaft and stope with waste rock to a point approximately 11 feet below the Coconino sandstone.
19. Using a concrete bucket suspended from a cable, pour a 6-foot thick concrete plug on top of the rock fill. NOTE: The ventilation shaft was bored by machine. The walls, although relatively smooth, are typically sufficiently grooved by the reamer employed in making the opening to promote a good bonding action between the shaft walls and the concrete.
20. Place 5 feet of bentonite on top of concrete plug.
21. Fill shaft with 38 feet of "native clay formation" to seal off Coconino sandstone.
22. Place 5 feet of bentonite on top of native clay.
23. Fill ventilation shaft with waste rock to within 35 feet of surface.
24. Drill and blast 10-foot diameter keyway at 4846 elevation.

25. Pour 5-foot, steel-reinforced concrete plug.
26. Place 5 feet of bentonite on top of concrete.
27. Fill shaft with waste rock to within 10 feet of surface.
28. Fill remaining portion of shaft with surface soil.

The shaft plug at the 3854 elevation will be poured on a wooden platform supported by steel beams which now form part of an existing shaft set. The raise plug will be poured on timbered lagging. All other concrete plugs will be poured directly on rock backfill. Sketches prepared by an EFNI engineer showing rebar size and spacing, concrete specifications, and plug dimensions are attached to this report.

While at the site, a visual examination was made of the Moenkopi derived soil to be placed in the shafts. The material appeared to have high clay and shale contents, which should make it suitable for its intended purpose. Laboratory tests on samples of the material to determine its suitability are currently being performed by the firm of Chen Northern, Inc. in Denver. The test results, however, were not yet available at the time this report was prepared.

Has some bentonite in soil

CONCLUSIONS

It is the opinion of Behre Dolbear that EFNI closure plan for the Hermit Mine meets or exceeds the requirements of Groundwater Quality Protection Permit No. G-0035-08. Migration of any mine inflow to the Muav limestone is essentially precluded by the fact that the two shafts bottom in the tight Hermit shale which should preclude any possible intermingling of aquifer waters. Further protection is afforded by the design of the concrete plugs and bentonite caps which are more than adequate to insure compliance with the permit requirements. Finally, the apparent clay content of the Moenkopi derived soil should insure the isolation of the Toroweap-Coconino formations from the lower geologic units.

ATTACHMENTS

EFNI CONCRETE PLUG DESIGNS

SHAFT PLUG - 3854 LEVEL

SCALE 1" = 50'

SHAFT SIZE : 16' X 7'

KEYWAY SIZE: 20' X 11'

REBAR MATS - #6 BAR

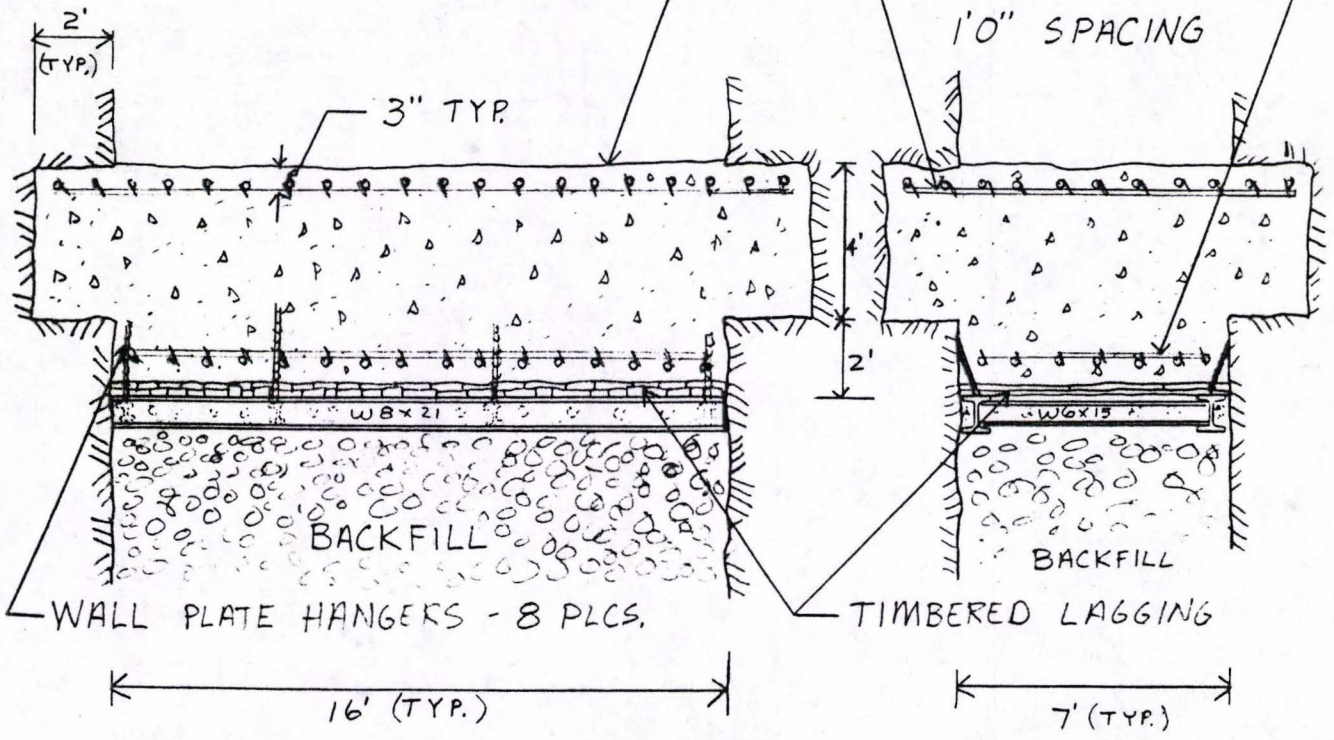
5½ BAG CONCRETE - 2800 PSI

6' THICK - 40.9 YDS.

TOP 19' X 10'

BOTTOM 15' X 6'

1'0" SPACING



SHAFT PLUG 4846 LEVEL

SHAFT SIZE : 16' X 7'

SCALE 1" = 50'

KEYWAY SIZE : 20' X 11'

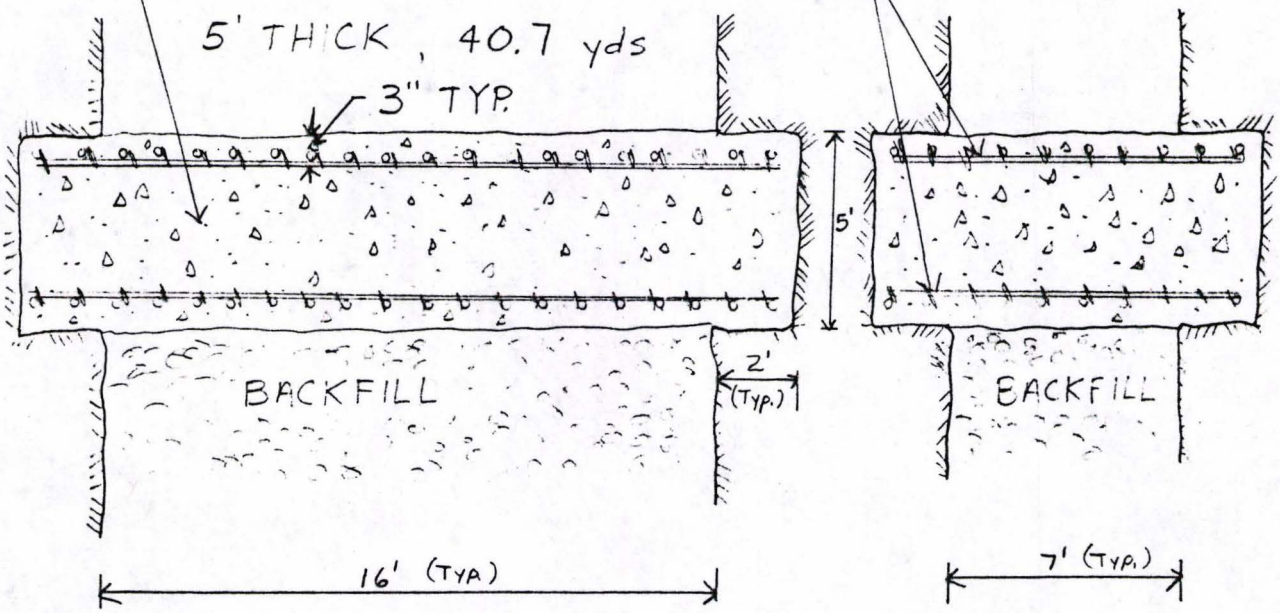
REBAR MATS - #6

19' X 10' - 1' SPACING

5½ BAG CONCRETE - 2800 PSI

5' THICK , 40.7 yds

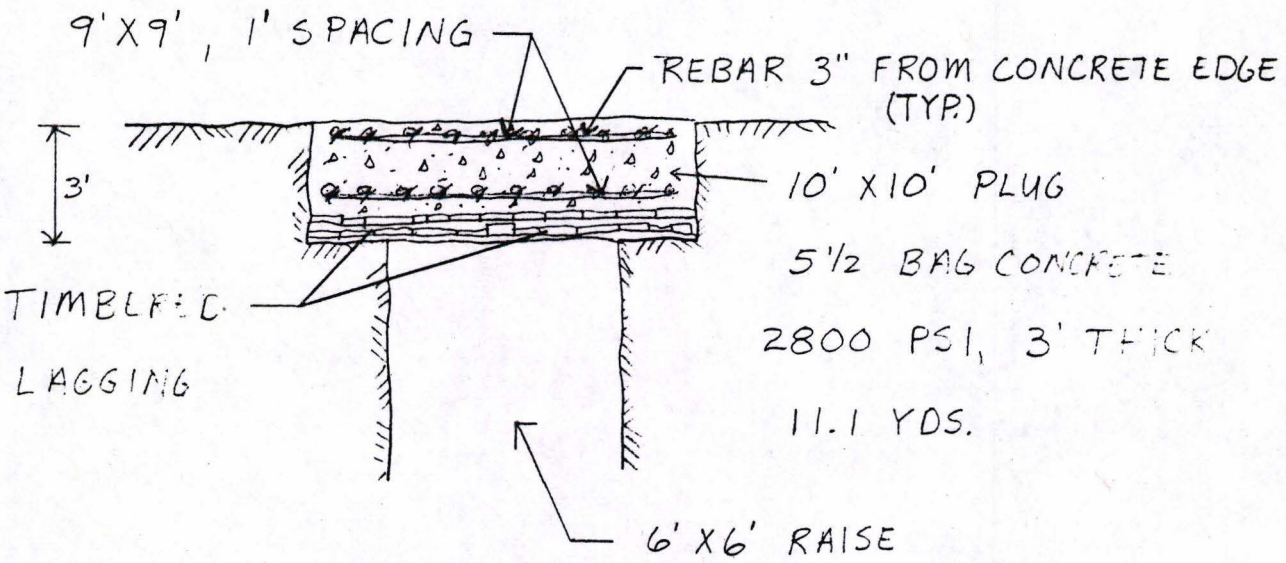
3" TYP.



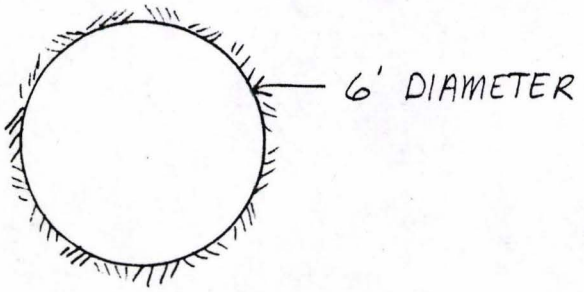
RAISE PLUG 3920 LEVEL

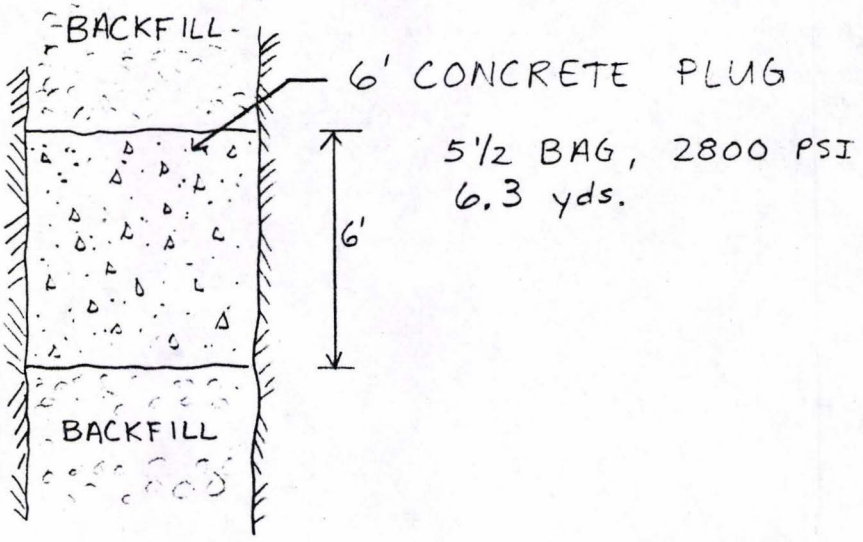
6' X 6' RAISE

SCALE 1" = 50'

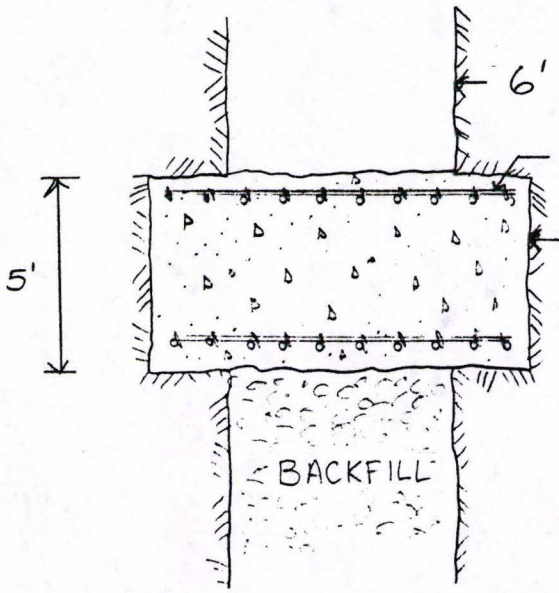


VENTILATION SHAFT PLUG - 3930 LEVEL



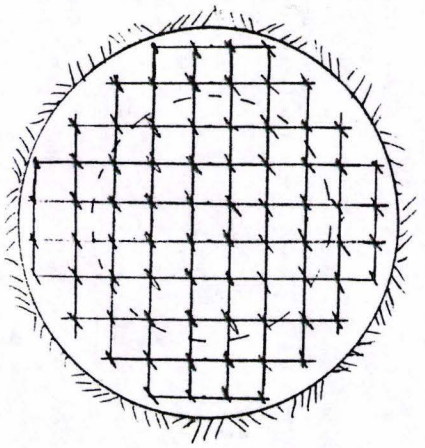


VENTILATION SHAFT PLUG, 4846 LEVEL



5' CONCRETE PLUG, 2800 PSI

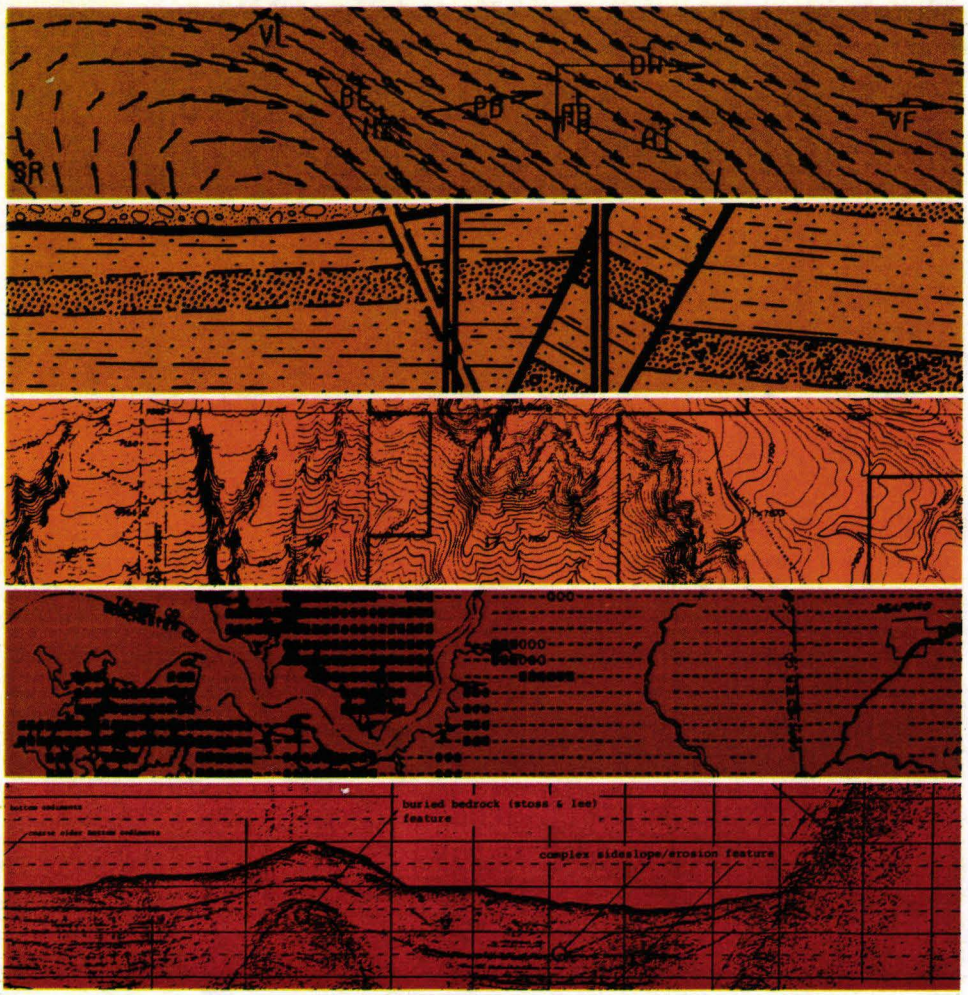
5½ BAG, 14.5 YDS.



REBAR MAT, TOP AND BOTTOM

1' BAR SPACING, #6 REBAR

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REPORT
HYDROLOGIC EVALUATIONS
FOR THE
PROPOSED HERMIT URANIUM MINE #100299
IN MOHAVE COUNTY, ARIZONA
FOR
ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

Dames & Moore

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

02/1987

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FOR THE
PROPOSED HERMIT URANIUM MINE #100299
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Dames & Moore

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Golden, CO 80401
(303) 232-6262
Job No. 09973-033-030
February 1987

Dames & Moore

1626 Cole Boulevard
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(303) 232-6262
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February 2, 1987
Our Ref: 09973-033-030

Mr. Stephen P. Antony
Energy Fuels Nuclear, Inc.
One Tabor Center
Suite 2500
Denver, CO 80202

Re: Hydrologic Evaluations for
The Proposed Hermit Uranium Mine
in Mohave County, Arizona

Dear Mr. Antony:

This letter transmits, herewith, ten (10) copies of the final report for the above referenced project.

We have enjoyed performing this work for you. If you have any questions regarding this report or require additional information, please contact us.

Very truly yours,

DAMES & MOORE

Anand Prakash/aec
Anand Prakash
Associate

Richard L. Harlan
Associate

AP:RLH:sj

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1.0 INTRODUCTION

1.1 SCOPE OF STUDY

Energy Fuels Nuclear, Inc. (Energy Fuels) plans to develop an underground uranium mine at the Hermit site in Section 17, Township 39 North, Range 4 West, Gila and Salt River Meridian, Mohave County, approximately 22 miles south-southwest of Fredonia, Arizona. This document describes the hydrologic and hydraulic analyses performed to evaluate the potential impacts of the proposed mining activities on the surrounding surface water environment.

The scope of this study included the following main tasks:

- Assessment of the climatic and hydrologic conditions in the vicinity of the Hermit Mine.
- Determination of the hydrologic characteristics of watersheds near the mine site.
- Estimation of peak flows of different recurrence intervals from subwatersheds in the vicinity of the mine site.
- Development of a drainage control plan based on the 100-year flood.
- Evaluation of potential project-related and cumulative downstream hydrologic impacts.

1.2 PROJECT OVERVIEW

The Hermit Project will involve sinking a vertical shaft approximately 1,100 feet below the surface. The surface facilities will consist of a headframe, main building and a new one-and-a-half mile access road. The areas proposed to be temporarily used or disturbed during the life of the project include about 20.4 acres for the surface facilities and rock disposal and about 5 acres for a new access road to the site.

The Project Area is located on the Kanab Plateau within the Grand Canyon section of the Colorado Plateau physiographic province in the watershed of Bulrush Canyon which is a minor tributary of Kanab Creek.

After development activities are completed (approximately three years after start-up), the project will operate at an average production rate of 300 tons per day for about five years. The barren waste rock generated during shaft sinking and mining will be disposed of in designated waste disposal areas. Prior to the construction of the mine yard, topsoil from the areas to be disturbed will be removed and stored on site. Uranium ore excavated from mine workings will be stockpiled on ore pads. The ore pads will be at least one-foot thick and will be constructed of shale and limestone material.

To minimize hydrologic impacts related to the project, surface runoff from the adjoining watersheds will be diverted around the mine area and the runoff and sediment generated within the mine area will be contained within the project boundary. A description of the proposed flood diversion and retention facilities is provided in the subsequent sections.

2.0 HYDROLOGIC EVALUATIONS

2.1 REGIONAL CLIMATE AND HYDROLOGY

The proposed Hermit Mine is located in the Grand Canyon region of the Colorado River basin in a semi-arid continental climate. The ground elevations in the region vary from above 5200 feet (MSL) in the uplands to lower than 3000 feet (MSL) in the valleys. The region is characterized by cool winters with some snow and below freezing night temperatures to warm summers with high temperatures rising above 90°F. The average annual precipitation in the region varies from about 11 to 15 inches. The annual precipitation for the driest and wettest years at Grand Canyon National Park for the period of record, 1931-1982, have been 7.14 inches in 1976 and 25.51 inches in 1982, respectively. The average annual precipitation at the station is 14.42 inches. Approximately one-half of the annual precipitation in the uplands occurs as snow. A typical distribution of the annual precipitation into monthly increments at Tuweep, Arizona is shown in Table 2.1 (NOAA, 1973).

TABLE 2.1 TYPICAL DISTRIBUTION OF INCREMENTAL MONTHLY PRECIPITATION AT TUWEEP, ARIZONA

Month	Precipitation (inches)	Month	Precipitation (inches)
January	1.10	July	1.28
February	0.90	August	1.97
March	1.25	September	0.79
April	0.73	October	0.80
May	0.40	November	0.77
June	0.40	December	1.31
		TOTAL ANNUAL	11.70

The area is subject to both localized convective storms (thunderstorms) and general frontal-type storms covering relatively large areas (i.e., larger than 10 sq. miles). The thunderstorms generally occur as single cells of intense vertical convection resulting from an invasion of marine air from the Gulf of Mexico or Gulf of California and are prevalent in the summer months of July to mid-September. In the winter (from Novem-

ber to March), frontal type systems are more prevalent with usually light but wide-spread and long lasting rains mixed with snow moving from the west to east. These storm systems derive their moisture from the Pacific Ocean.

2.2 LOCAL HYDROLOGY

2.2.1 Watershed Characteristics

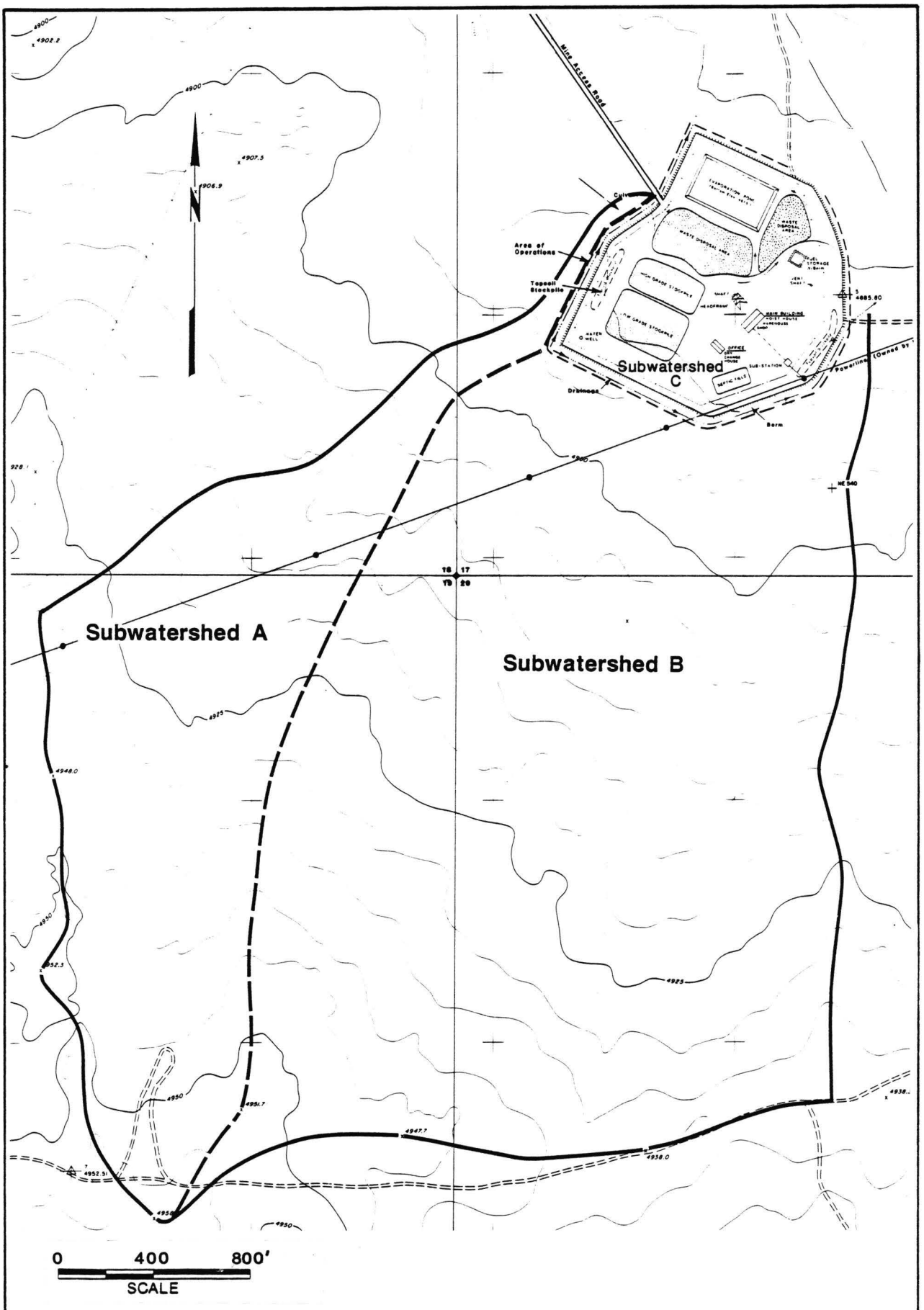
To perform a hydrologic evaluation of the Project Area, the basin around the mine site was divided into three different subwatersheds as shown in Figure 1. Subwatershed A includes the area upstream of the Project Area on the southwest; subwatershed B includes the area to the south of the Project Area; and subwatershed C includes the area within the Project boundary. A map of subwatershed C along with the proposed surface facilities is shown in Figure 2. The areal extents, hydraulic lengths, topographic relief, and times of concentrations for these subwatersheds are shown in Table 2.2.

TABLE 2.2 HYDRAULIC CHARACTERISTICS OF SUBWATERSHEDS

Subwatershed	Area (sq mi)	Hydraulic Length (feet)	Topographic Relief (feet)	Time of Concentration (hour)
A	0.105	4,448	64	0.429
B	0.251	4,268	66	0.404
C	0.032	800	10	0.121

The time of concentration is defined as the time a drop of water takes to travel from the farthest point in the watershed to the point where the surface runoff hydrograph is to be computed. The equation used to estimate the time of concentration is (USBR, 1977):

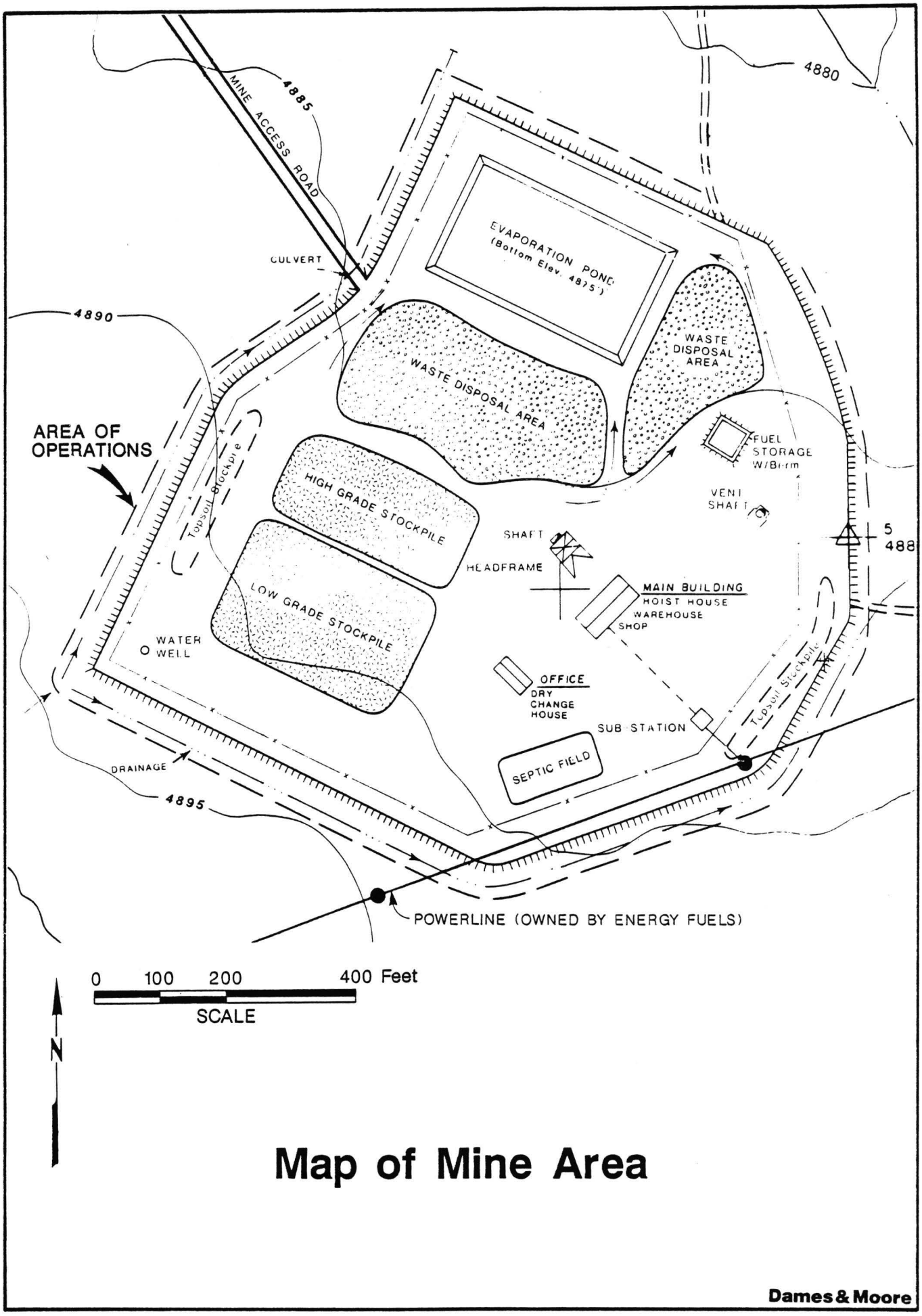
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Subwatersheds in the Vicinity of the Hermit Project

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Figure 1



Map of Mine Area

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Figure 2

$$t_c = \left(\frac{11.9\ L^3}{H}\right)^{0.385} \qquad (2.1)$$

where, t_c = time of concentration in hours,

L = hydraulic length of the longest water course in the basin in miles,

H = topographic relief of the subwatershed in feet, i.e., difference in elevation between the furthest point in the watershed and the location where the runoff hydrograph is to be computed

The general vegetative cover in the Project Area consists of grasses and sagebrush with bare rock and soil exposed over about 50 percent of the area. Vegetation and plants exceeding three feet in height are almost non-existent. The three subwatersheds mentioned previously are comprised of moderately undulating plateaus and mesas with average ground slopes of about 1.0 to 1.5 percent. The surface soils consist of residuum and alluvium weathered from limestones and siltstones. For the natural subwatersheds A and B, a Soil Conservation Service curve number (CN) of 72 is adopted assuming AMC-II type of antecedent moisture conditions.

The curve number (CN) is an index used to estimate the surface runoff potential of a watershed for a given depth of precipitation. It depends on the hydrologic soil group of the surface soils, type and condition of land-use or surface cover, hydrologic condition of the watershed for infiltration, and antecedent moisture condition of the soils at the time of the occurrence of the storm (SCS, 1972). The silty and sandy soils in the Project Area are judged to belong to hydrologic soil groups B to C. The small portions of the subwatersheds having rock outcrops belong to hydrologic soil group D. Hydrologic soil groups B, C, and D refer to soils with moderate, slow, and very slow rates of water transmission or moderately fine to moderately coarse, moderately fine to fine, and clay like textures,

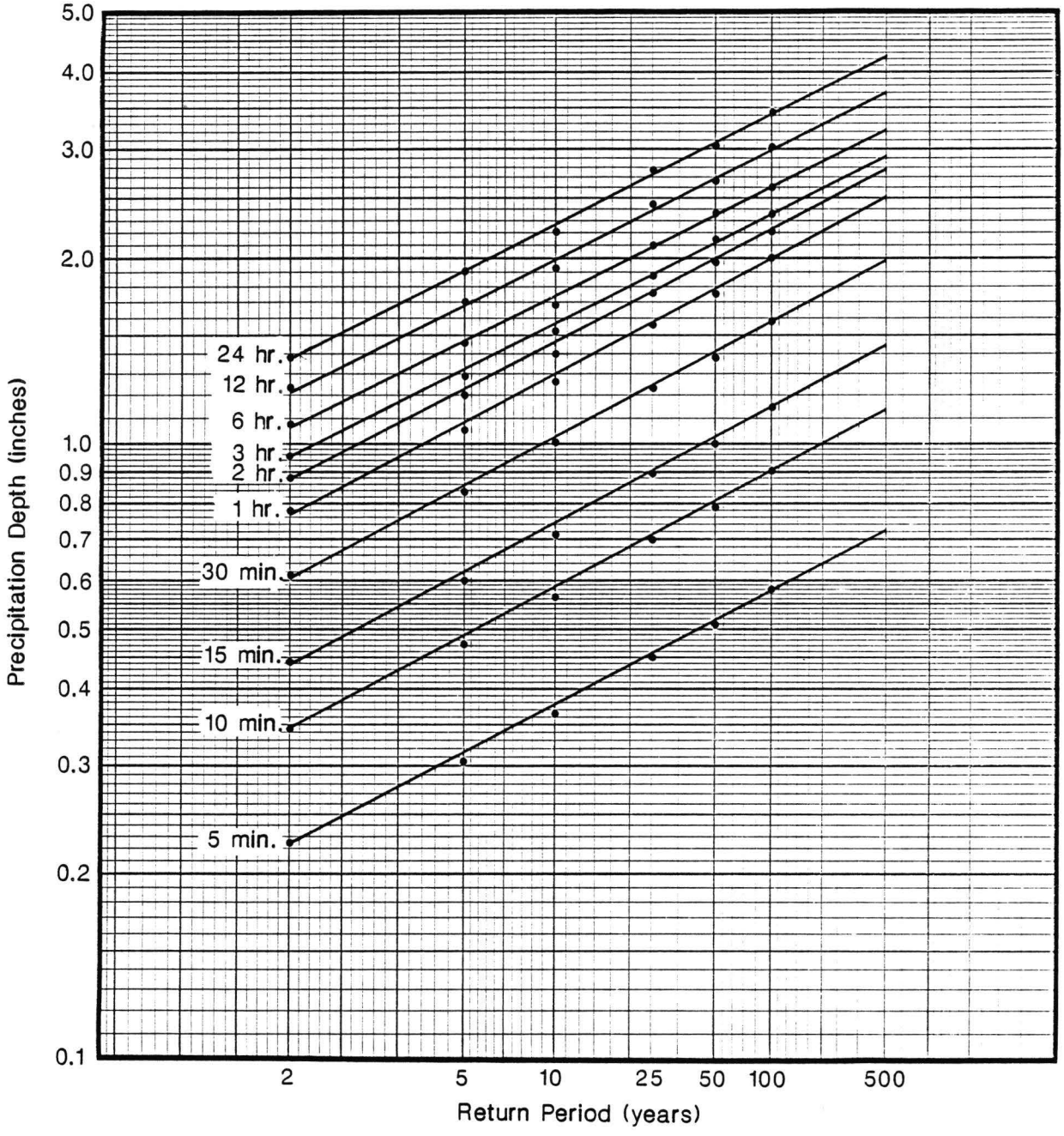
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respectively. The land use or vegetal cover for these areas is judged to be similar to pastures or ranges with moderate cover of sagebrush and poor to fair conditions for infiltration. The AMC-II type of antecendent moisture condition implies average moisture conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (USBR, 1977).

Before the operation of the mine, subwatershed C will be significantly altered from its natural condition. Some of the features to be installed in this subwatershed are shown in Figure 2. Some of the portions of this subwatershed will be covered with buildings or compacted. For this reason, a higher curve number (CN) of 74 is adopted for AMC-II conditions for this subwatershed.

2.2.2 Hydrologic Analyses

To develop the surface runoff hydrographs for the three subwatersheds listed in Table 2.2 for storm events of different recurrence intervals, the HEC-1 computer program of the U.S. Army Corps of Engineers (USACE, 1981) was used. The approximate location of the subwatersheds is near longitude 112°45' and latitude 36°41'30". The 5-min., 10-min., 15-min., 30-min., 1-hour, 2-hour, 3-hour, 6-hour, 12-hour, and 24-hour precipitation depths for recurrence intervals of 2 to 100 years used as input to this model were computed using the Precipitation-Frequency Atlas for the Western United States, Volume VIII, Arizona (NOAA, 1973). To estimate the precipitation depths for a recurrence interval of 500 years, the aforementioned values were plotted on a lognormal probability paper. The 500-year precipitation depths were then estimated by linear extrapolation. The lognormal probability plots of precipitation depths are shown in Figure 3 and the cumulative precipitation depths for all the durations and recurrence intervals are shown in Table 2.3.



Lognormal Probability Plots of Precipitation Depths of Different Durations

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Figure 3

TABLE 2.3 CUMULATIVE PRECIPITATION DEPTHS NEAR HERMIT PROJECT (inches)

Recurrence Interval/ Duration	2-yr.	5-yr.	10-yr.	25-yr.	50-yr.	100-yr.	500 yr.
5 min.	0.225	0.305	0.363	0.450	0.508	0.580	0.72
10 min.	0.349	0.473	0.563	0.698	0.788	0.900	1.13
15 min.	0.442	0.599	0.713	0.884	0.998	1.140	1.44
30 min.	0.613	0.830	0.988	1.225	1.383	1.580	1.99
1 hr.	0.776	1.05	1.25	1.55	1.75	2.00	2.50
2 hr.	0.88	1.2	1.40	1.75	1.98	2.2	2.78
3 hr.	0.95	1.29	1.50	1.87	2.13	2.35	2.90
6 hr.	1.07	1.47	1.68	2.1	2.38	2.6	3.2
12 hr.	1.24	1.70	1.92	2.44	2.69	3.0	3.70
24 hr.	1.37	1.9	2.2	2.77	3.0	3.4	4.20

The lag time for each subwatershed is assumed to be 60 percent of the respective times of concentration shown in Table 2.2. The lag time for a subwatershed is defined as the time from the center of mass of the rainfall excess to the time of occurrence of the peak rate of runoff (SCS, 1972).

In addition to the cumulative precipitation depths shown in Table 2.3, the areal extent of each subwatershed (Table 2.2), the lag time, and the curve numbers (CN) described previously are provided as input to the HEC-1 computer program (USACE, 1981). The resulting peak flows, runoff coefficients for the 24-hour storms, and volumes of surface runoff for each subwatershed are presented in Tables 2.4 (a), 2.4 (b), and 2.4 (c).

TABLE 2.4 (a) ESTIMATED PEAK FLOWS AND RUNOFF VOLUMES, SUBWATERSHED A
(Area = 0.105 sq. mi.)

RESULTS OF HEC-1 COMPUTER PROGRAM
Curve Number (CN) = 72
AMC-II

Return Period (years)	Runoff Coefficient	Peak Flow (cfs)	Runoff Volume (acre-ft)
2	0.058	5	0.45
5	0.132	22	1.40
10	0.173	36	2.13
25	0.243	68	3.75
50	0.268	88	4.48
100	0.310	116	5.88
500	0.380	184	8.90

TABLE 2.4 (b) ESTIMATED PEAK FLOWS AND RUNOFF VOLUMES, SUBWATERSHED B
(Area = 0.251 sq. mi.)

RESULTS OF HEC-1 COMPUTER PROGRAM
Curve Number (CN) = 72
AMC-II

Return Period (years)	Runoff Coefficient	Peak Flow (cfs)	Runoff Volume (acre-ft)
2	0.058	12	1.07
5	0.132	53	3.35
10	0.173	88	5.09
25	0.243	167	8.97
50	0.268	215	10.71
100	0.310	282	14.06
500	0.380	450	21.28

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TABLE 2.4 (c) ESTIMATED PEAK FLOWS AND RUNOFF VOLUMES, SUBWATERSHED C
(Area = 0.032 sq. mi.)

RESULTS OF HEC-1 COMPUTER PROGRAM
Curve Number (CN) = 74
AMC-II

Return Period (years)	Runoff Coefficient	Peak Flow (cfs)	Runoff Volume (acre-ft)
2	0.080	4	0.19
5	0.158	16	0.51
10	0.205	26	0.77
25	0.275	49	1.30
50	0.301	62	1.54
100	0.342	82	1.98
500	0.414	128	2.95

The values in Tables 2.4 (a), 2.4 (b), and 2.4 (c) are judged to represent reasonable design bases for hydraulic structures. The 10-year and 100-year flood hydrographs for AMC-II conditions for subwatersheds A and B are shown in Figures 4 and 5, respectively.

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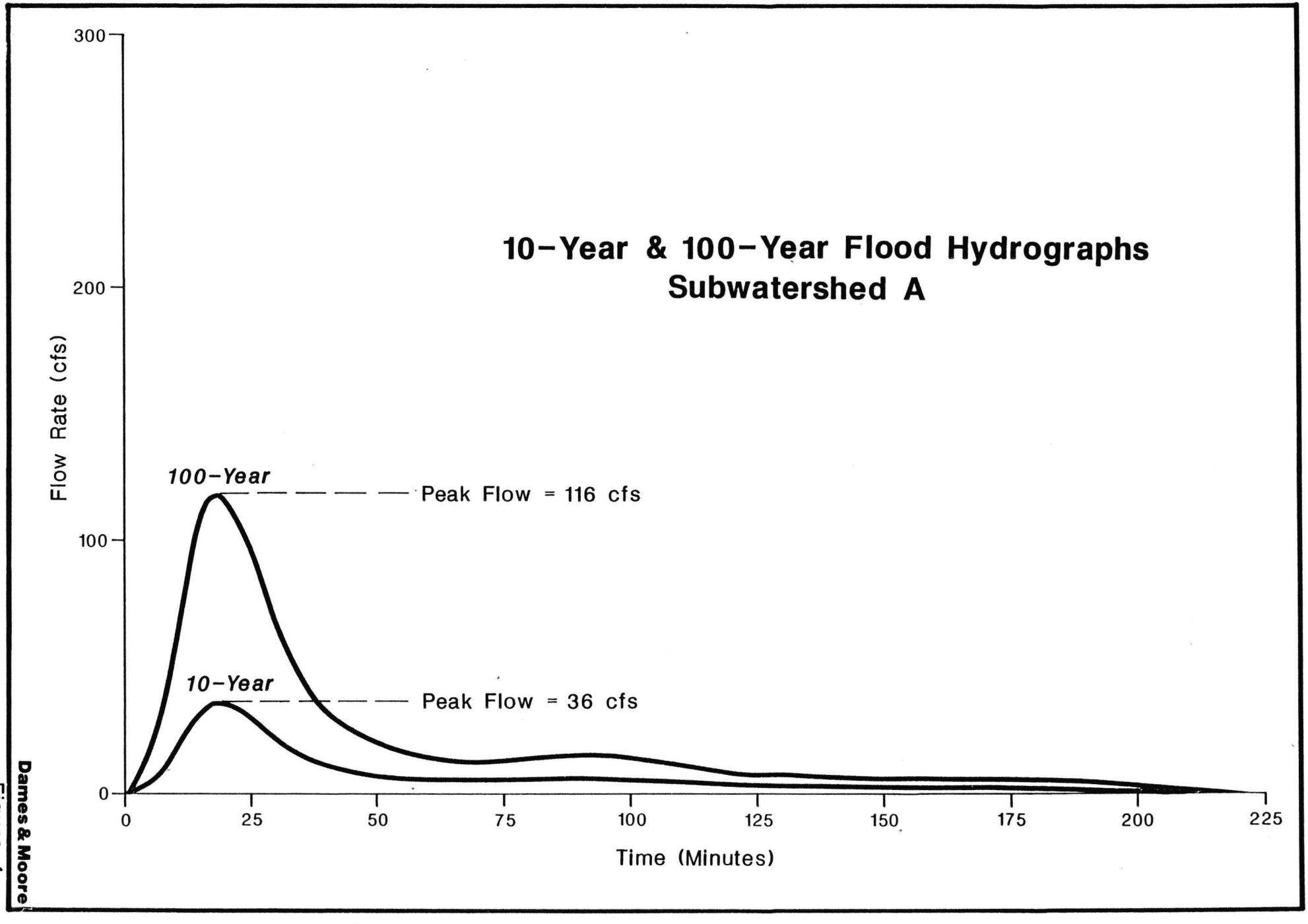

10-Year & 100-Year Flood Hydrographs
Subwatershed A
Flow Rate (cfs)
300
200
100
0
100-Year
Peak Flow = 116 cfs
10-Year
Peak Flow = 36 cfs
0
25
50
75
100
125
150
175
200
225
Time (Minutes)
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Figure 4

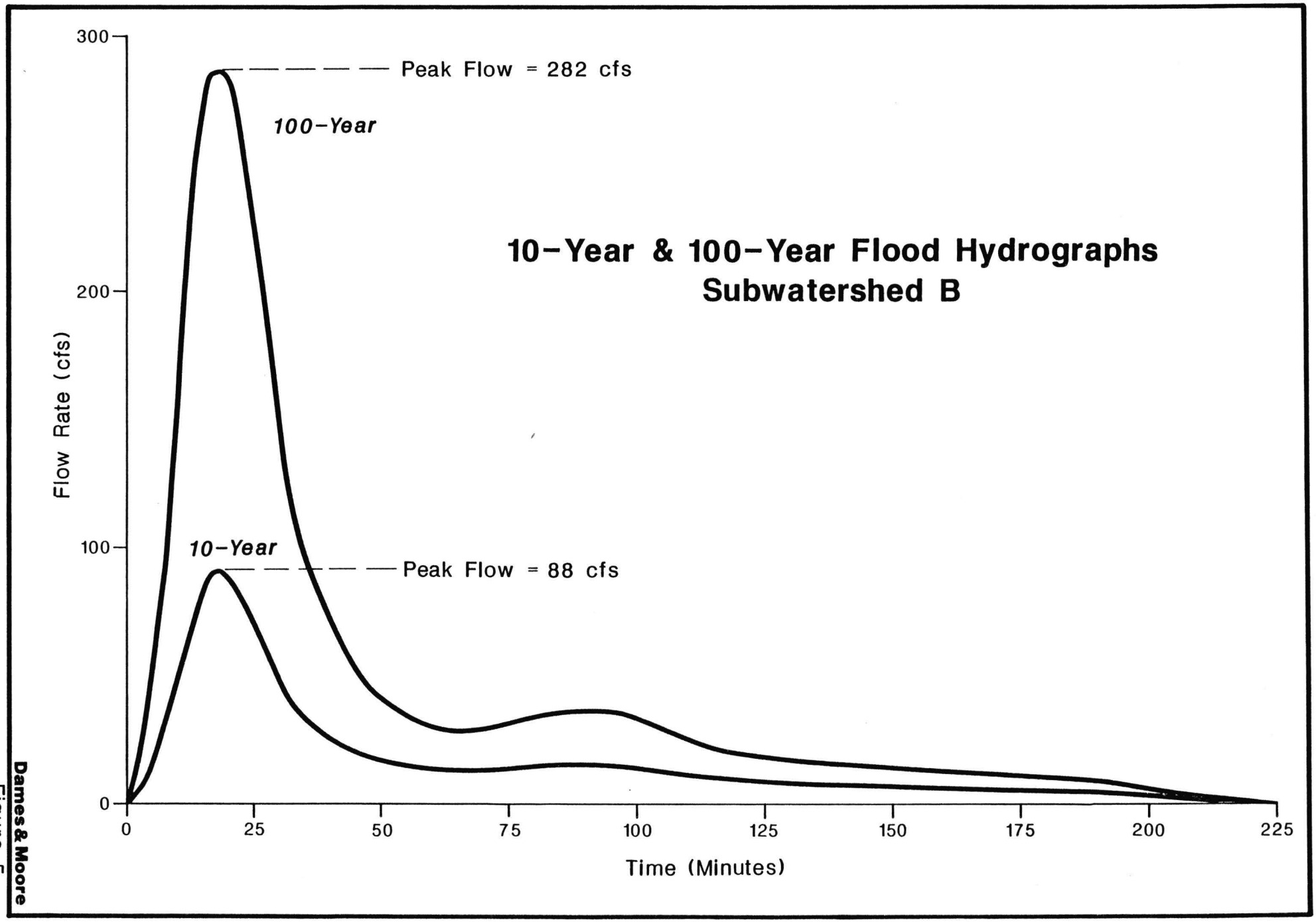

10-Year & 100-Year Flood Hydrographs
Subwatershed B
Peak Flow = 282 cfs
100-Year
Peak Flow = 88 cfs
10-Year
Flow Rate (cfs)
Time (Minutes)
300
200
100
0
0
25
50
75
100
125
150
175
200
225
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Figure 5

3.0 SURFACE DRAINAGE CONTROL PLANS

3.1 OBJECTIVES OF SURFACE RUNOFF CONTROL

Current regulations and environmental considerations require that the surface runoff control system for the proposed Hermit Project meet the following objectives:

- Surface runoff diversion facilities for subwatersheds upstream of the Project Area should, as a minimum, be designed to control runoff from a 10-year 24-hour storm event.

- The release of radioactive materials into the surface and ground water environment due to erosion from uranium ore stockpiles or otherwise should be prevented even during extreme events up to the 500-year 24-hour storm. To meet this objective, the on-site retention structures should be designed to store surface runoff from the 500-year 24-hour storm with appropriate allowance for sedimentation and disposal/storage of all mine-related water.

- The ground surface and facilities within the Project Area should be graded as to ensure that the surface runoff and eroded material reach the on-site retention structures without spilling over the site boundary.

- The flood diversion system should be designed to cause minimal impacts/changes in the existing drainage patterns of the area.

3.2 PROPOSED DRAINAGE CONTROL PLANS

The proposed surface runoff control plan includes two diversion ditches along the northwestern and southern boundaries of the site area. These diversion ditches would convey surface runoff from subwatersheds A and B, respectively. These ditches would be designed to pass the 100-year 24-hour flood peak from their respective drainage areas with sufficient freeboard to handle the 500-year, 24-hour flood peak without undue damage. This will

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ensure that surface runoff from subwatersheds upstream of the Project Area does not enter the site boundary. As an additional measure to prevent run-on to the Project Area, a peripheral dike will be constructed around the Property boundary.

To eliminate the potential for the release of surface runoff and sediments out of the Project Area, an evaporation pond will be constructed on site to store the 500-year, 24-hour storm runoff volume from the area within the site boundary, sediment yield from the area for a period of about five years, carry over runoff from a wet period assumed to be equivalent to a 2-year 24-hour storm runoff volume, and any additional mine-related water. The evaporation pond will be cleaned of deposited sediment as and when required to maintain the aforementioned storage capacity at all times during the operation of the mine.

3.3 SEDIMENTATION ANALYSIS

For a preliminary estimate of the sediment yield of the area within the site boundary, e.g., subwatershed C, the Universal Soil Loss Equation is used with the following parameters (SCS, 1976):

$$A = RKLSCP \qquad (3.1)$$

where, A = estimated sediment yield in tons/acre/year

R = rainfall factor which is estimated to have a value of 40 for the site area

K = soil erodibility factor assumed to be 0.2 for the compacted and partially armored surfaces in the site area after development

LS = slope factor assumed to be 0.55 for about 1.25 percent slope over a length of about 4000 feet in subwatershed C upstream of the proposed retention pond

C = crop management factor taken to be 0.45 for almost no ground cover and no appreciable canopy on the surface

P = erosion control factor, conservatively assumed to be 1.0

Substitution of these values in the Universal Soil Loss Equation results in a sediment yield of 1.98 tons/acre/year or 40.39 tons/year for the total area of 20.4 acres for subwatershed C. Assuming the unit weight

of sediment to be 100 lbs/cft, the annual sediment yield is estimated to be 808 cft requiring a capacity of 0.10 acre-ft. to store the sediment load generated in five years.

3.4 DESIGN SPECIFICATIONS

3.4.1 Diversion Ditches

For nearly maintenance free operation, the diversion ditches will be excavated with bed slopes approximately equal to the existing ground slope. Also assuming that the ditches will develop some vegetation along their banks over time, a Manning's n value of 0.04 is conservatively assumed. The hydraulic design parameters for a trapezoidal ditch along the northwestern edge of the Project Area are:

100-year peak flow (subwatershed A) = 116 cfs
Bed slope: S = 0.010 ft/ft
Bed width = 12 ft, side slopes = 2H:1V
Water depth = 1.7 ft, Area = A = 26.18 sq ft
Wetted perimeter = 19.60
Hydraulic mean depth= R = 1.33 ft

$$\text{Velocity} = \frac{1.486}{n} R^{2/3} S^{1/2} \qquad (3.2)$$

= 4.5 ft/sec (Chow, 1959)

Total depth of excavation with a freeboard of 0.3 ft = 2.0 ft
Height of peripheral dike above ground on the northwestern edge = 2 ft
d_{50} of riprap along the channel bank toward the site boundary = 1.5 in.

This size of riprap will provide an adequate factor of safety against the boundary shear produced by the estimated maximum velocities in the channel (USACE, 1970; 1971). This nominal riprap will be provided only on the bank toward the Project Area. The outer bank will be protected by vegetation cover. The permissible non-scouring velocity for vegetated channels excavated in easily erodible soils with 0 to 5 percent bed slopes varies from about 2.5 to 5 ft/sec (Barfield, Warner, and Haan, 1981). The computations for riprap size are abstracted below:

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Local boundary shear in lbs per sq ft = $T_o = \frac{w\ V^2}{\left[32.6\ \text{Log}\ \frac{12.2y}{d_{50}}\right]^2}$ (3.3)

Design resisting shear = $T = 0.040\ (w_s - w)\ d_{50}$ (3.4)

Design shear corrected for riprap placed on channel slopes =

$$T^1 = T\left[1 - \frac{\text{Sin}^2\ a}{\text{Sin}^2\ b}\right]^{0.5} \quad (3.5)$$

Factor of safety = T^1/T_o

where w = unit weight of water = 62.4 lbs/cft

w_s = unit weight of stone = 165 lbs/cft

y = water depth in channel in ft

d_{50} = average stone diameter in ft

a = angle of channel bank slope with the horizontal = 26.57°

b = angle of repose of riprap = 42° (Barfield, Warner, and Haan, 1981)

Thus, T_o = 0.2413 lbs/sq ft; T = 0.513 lbs/sq ft; T^1 = 0.3815 lbs/sq ft, and factor of safety = 1.58

Thickness of riprap = 2.25 inches

Hydraulic design parameters for the trapezoidal ditch along the southern edge of the site boundary are:

100-year peak flow (subwatershed B) = 282 cfs

Bedslope = S = 0.0064 ft/ft

Bed width = 12 ft, side slopes = 2H:1V

Water depth = 3.1 ft, Area = A = 56.42 sq ft

Wetted perimeter = 25.863 ft

Hydraulic mean depth = R = 2.18 ft

Velocity = $\frac{1.486}{n} R^{2/3} S^{1/2}$

= 5.0 ft/sec (Chow, 1959)

Total depth of excavation with a freeboard of 0.4 ft = 3.5 ft

Height of peripheral dike above ground on the southern edge of the site boundary providing an additional freeboard = 2 ft

d_{50} of riprap along the channel bank toward the site boundary = 1.5 inches

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Using equations 3.3, 3.4, and 3.5 for the velocity and water depth in the channel, T_o = 0.2385 lbs/sq ft; T = 0.513 lbs/sq ft; T^1 = 0.3815 lbs/sq ft; and factor of safety = 1.6
Thickness of riprap = 2.25 inches

Since the channel velocities during extreme flood events are in the range of 4.5 to 5.0 ft/sec, riprap protection will be provided only along the channel bank towards the Property boundary. The outer bank will be protected by vegetation. As stated previously, the permissible channel velocity for vegetated channels excavated in easily erodible soils with 0 to 5 percent bed slopes varies from about 2.5 to 5 ft/sec (Barfield, Warner, and Haan, 1981).

3.4.2 Evaporation Pond

The storage capacity of the evaporation pond is estimated to be as follows:

o	500-year 24-hour storm runoff volume (AMC-II)	2.95 acre-ft
o	Capacity for carry over runoff from a wet period (assumed to be equal to the 2-year 24-hour storm runoff volume (AMC-II))	0.19 acre-ft
o	Volume of sedimentation for five years	0.10 acre-ft
	Subtotal	3.24 acre-ft
o	Capacity for mine water assumed to be 10 percent of the above capacity	0.33 acre-ft
	Total Capacity	3.57 acre-ft
	say	4.0 acre-ft

3.4.3 Drainage Crossing

As shown in Figure 2, a drainage crossing (culvert) will be installed at the indicated location on the northwestern diversion ditch. This culvert will be designed to pass the design discharge of 116 cfs without overtopping.

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An appropriate size for this drainage crossing has been selected using the methods given in Hydraulic Engineering Circular No. 5 of the Bureau of Public Roads (BPR, 1965) and Handbook of Steel Drainage and Highway Construction Products (AISI, 1971). Inlet control conditions have been assumed. In addition, the following general criteria have been followed:

- As far as possible, the culvert invert is laid at the natural grade of the stream in the vicinity of the crossing.
- To minimize maintenance and chances of blockage due to debris accumulation, a minimum culvert opening equivalent to a 24-inch diameter pipe has been adopted.
- The maximum permissible design headwater elevation is taken to be less than or equal to the least of the following:

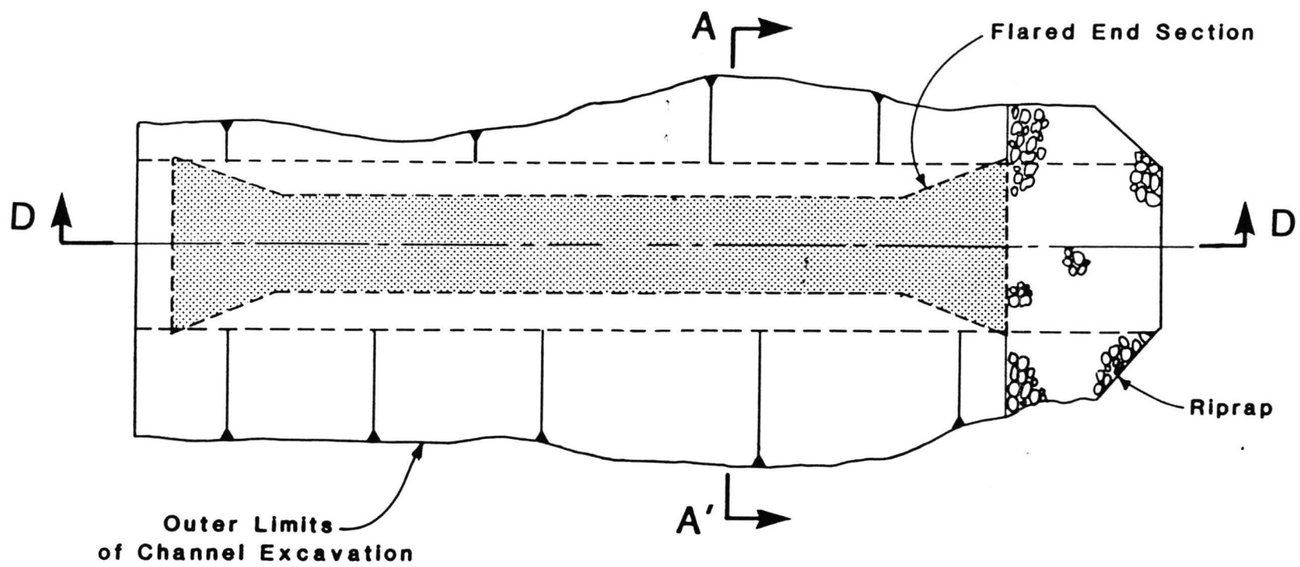
  (a) 1.5 x depth of opening above the invert for inlet control
  (b) 1.5 ft below the crest of the embankment

The suggested type and size of drainage crossing is shown in Table 3.1. The plan and section of a typical pipe culvert are shown in Figure 6.

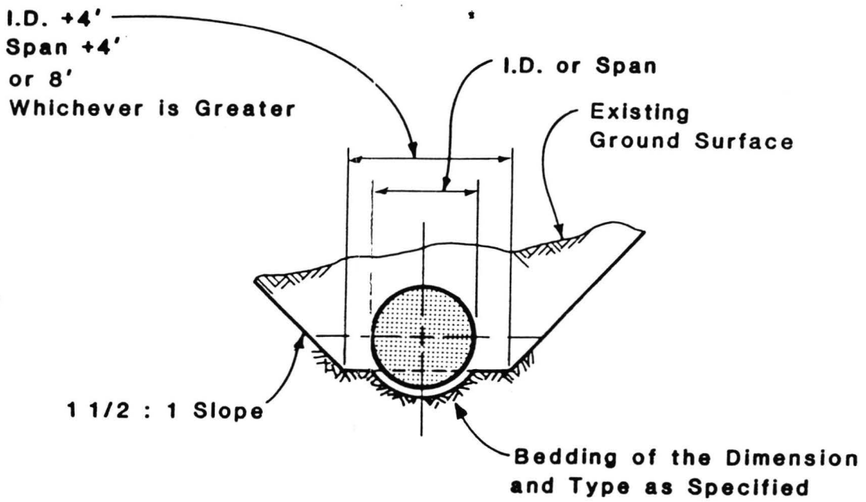
TABLE 3.1 DESIGN DISCHARGE AND SIZE OF CULVERT

Description	Design Discharge (cfs)	Type and Size of Crossing
Culvert on northwestern ditch	116	Two 50 in x 31 in corrugated steel pipe arches or equivalent

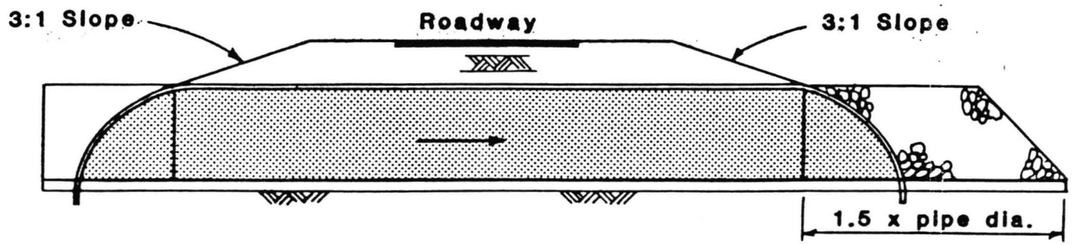
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Plan



Section A–A'



Section D–D'

Dames & Moore 1626 Cole Boulevard Golden, Colorado 80401 (303) 232-6262 TWX: 910-991-2080		NUMBER
Plan and Sections of Typical Pipe Culvert		DESIGNED DRAWN DATE PLATE OF

Figure 6

4.0 HYDROLOGIC IMPACTS

4.1 FLOODING POTENTIAL

With the diversion ditches designed to pass the 100-year flood peaks and additional freeboard provided in the channel design and that available due to the proposed dike, no flood damage is expected to any facility at the mine site. Because of available freeboard, the mine site facilities are flood proof for much more severe floods than the 100-year event. Some overland and overbank flooding may occur, during the 500-year storm event on the channel flank farther from the site boundary. However, this overbank flooding is not expected to be more severe than that expected under the existing conditions. At present, the entire storm runoff from subwatersheds A and B runs through natural depressions or rills or as overland flow. The construction of the proposed ditches will channelize flood flows and minimize overland flow and the associated soil erosion. Any overbank flows spilling over the channel banks would be much less than the overland flows without the ditches (i.e., under existing conditions).

The on-site retention pond has a capacity to store more than the volume of the 500-year 24-hour storm runoff from the Project Area. Therefore, the flooding potential downstream of the mine site will be somewhat attenuated and the streamflows will be somewhat reduced. However, the area of subwatershed C, from which the surface runoff will be contained is only 8.3 percent of the total area of the watershed contributing runoff to the point immediately downstream of the Project Area. Therefore, the overall impact at this location will be minimal and will become insignificant at points further downstream.

4.2 EROSION POTENTIAL

With the riprap and/or vegetation proposed along the inner banks of the diversion ditches, the potential for bank erosion will be minimized. Some erosion may be expected on the outer (unprotected) banks of these diversion ditches. However, the channel velocities for the most extreme flood events are in the range of 4.5 to 5.0 ft/sec as compared to the reported non-scouring velocities of 2 to 3.5 ft/sec for channels excavated

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in alluvial silts (Chow, 1959). Therefore, the erosion potential during most flood events is expected to be minimal.

Any flood induced erosion within the Project boundary will be contained and therefore the impact of this erosion on the surrounding surface water environment will be insignificant.

4.3 ACCIDENTAL RELEASE OF CONTAMINANTS

As described in the previous sections, with the proposed design criteria, the probability of any eroded or accidently released contaminant getting out of the site area is extremely remote. To analyze a hypothetical scenario, it is postulated that some amount of contaminated liquid gets released into the surrounding surface water environment, during an unexpectedly severe event, e.g., in excess of a 500-year storm. This volume of contaminated liquid will first be diluted by the estimated 2.95 acre-ft of runoff volume generated within the Project Area (see Table 2.4 (c)). Further dilution will be provided by an additional total runoff volume of 30.18 acre-ft from subwatersheds A and B by the time the contaminant reaches the downstream end of the mine site area (see Tables 2.4 (a) and 2.4 (b). This will provide an additional dilution factor of about 11.2. Further dilution will be available when the contaminant reaches Bulrush Canyon and a dilution factor of about 2700 will be available in Kanab Creek giving a total dilution factor of about 24,000 between the concentrations in the water getting out of the mine site area and that flowing down Kanab Creek. It may be noted that the drainage area of Kanab Creek near Fredonia is 1,085 sq miles compared to a total drainage area of 0.388 sq mile for the subwatersheds upstream of the outlet point of the mine site area (USGS, 1979). Therefore, it is expected that the available dilution factors in Kanab Creek under other flow conditions will also be of the same order of magnitude as for the storm exceeding the 500-year event.

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5.0 CONCLUSIONS

The hydrologic impacts associated with the proposed Hermit Mine can be minimized by the construction of the peripheral dike, diversion ditches, and evaporation pond as described in Section 3.0. The following general guidelines are recommended for continued mitigation of hydrologic impacts on the mine facility and the surface water environment surrounding the site:

- The evaporation pond, dike, and diversion ditches should be routinely maintained to insure their integrity at all times during the operation of the mine with appropriate modifications during reclamation.

- The roads and road crossings should be monitored for signs of erosion. If any erosional damage is detected, the same should be repaired by riprap or other erosion control measures.

- All disturbed areas and channel banks (when required) should be properly vegetated to establish satisfactory vegetation cover.

6.0 REFERENCES

American Iron and Steel Institute (AISI), 1965, Handbook of Steel Drainage and Highway Construction Products, Washington, D.C.

Barfield, B.J., Warner, R.C., and Haan, C.T., 1981), Applied Hydrology and Sedimentology for Disturbed Areas, Oklahoma Technical Press,Stillwater, Oklahoma.

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U.S. Army Corps of Engineers (USACE), 1971, Additional Guidance for Riprap Channel Protection, ETL-1110-1-120, Department of the Army, Washington, D.C.

U.S. Bureau of Reclamation (USBR), 1977, Design of Small Dams, Denver, CO.

U.S. Geological Survey (USGS), 1979, Water Resources Data for Arizona, Water-Data Report AZ-79-1.

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100299

HERMIT MINE CLOSURE REPORT

DECEMBER 18, 1998

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

003

WATER PERMITS
DEC 24 1998
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HERMIT MINE CLOSURE REPORT

DECEMBER 18, 1998

Submitted by:

International Uranium (USA) Corporation
Independence Plaza, Suite 950
1050 Seventeenth Street
Denver, Colorado 80265

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

HERMIT MINE
CLOSURE REPORT

GROUNDWATER PROTECTION PERMIT NO. G-0035-08

D. CLOSURE/POST CLOSURE

1. The Department shall be notified in writing at least one hundred and eighty (180) days prior to closure or abandonment of the facility. The operator shall submit and have approved an updated Post-closure Plan prior to this time.

ACTION TAKEN:

On February 19, 1990, Energy Fuels Nuclear, Inc., predecessor to International Uranium (USA) Corporation (IUSA), submitted a letter to Mr. Gary Ullinskey and Ms. Abigail Myers of the Arizona Department of Environmental Quality (ADEQ), Water Permits Unit, notifying the ADEQ of the closure and abandonment of the Hermit Mine. A comprehensive engineering report, prepared by Behre Dolbear & Company ("Behre Dolbear"), outlining the proposed closure plan, accompanied the letter of notification. A copy of the letter and the engineering report are on file with the ADEQ.

2. Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations, on file with the Arizona Department of Environmental Quality. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of a clay plug, a 40% clay / 60% crushed shale plug or a bentonite plug in the main shaft, the air shaft and the monitoring well.

ACTION TAKEN:

At the cessation of mining operations, the operator implemented the closure plan as referenced in the approved Plan of Operations. The individual requirements listed in the Plan of Operations are identified and discussed below under VII. "Measures to Reclaim at the End of the Operations".

At the time of shaft closure, water in-flow was occurring from the Toroweap Formation mining zone, down the incline and into the production shaft at a rate estimated to be 7 - 13 gallons per

minute (gpm). As discussed, the objective of the closure plan was to isolate the flow from this zone and the flow from the Coconino Sandstone Formation, which underlies the Toroweap Formation mining zone. The flow, from these two areas, was isolated from the lower geologic units in the following manner:

1) **A 5-foot thick bentonite clay cap was placed on top of the backfill material in the shaft at the 3,912 foot elevation (974 foot depth) from the shaft collar.**

2) **A 2-foot thick bentonite clay cap placed on top of a 3-foot steel reinforced concrete plug, keyed into the wall rock at the top of the raise on the 3920 mine level.**

3) **A 5-foot bentonite clay cap was placed on top of a 6-foot thick concrete plug in the ventilation shaft at approximately the 3930 foot level.**

4) **The production shaft, the ventilation shaft and portions of the shaft station at the 3920 level were backfilled to the 3983 foot elevation with Moenkopi derived soil ("native clay"), obtained from surface excavations.**

5) **A 5-foot thick bentonite clay cap was placed on top of the native clay material.**

A comprehensive engineering report including a cross section that depicts the above referenced shaft closure technique, prepared by Behre Dolbear, is on file with the ADEQ.

HERMIT MINE PLAN OF OPERATIONS

VII. MEASURES TO RECLAIM AT THE END OF THE OPERATIONS

At the conclusion of mining activities, EFN will disassemble and remove the hoist/shop building and bury all concrete footings and concrete slab materials within the mine yard or backfill the material into the shaft. All facilities, materials, supplies and equipment will be removed. Low grade material will be removed from the site or backfilled into the mine shaft. The shaft entrance will be sealed to prevent entry by unauthorized members of the public, and the entire Area of Operations will be fully reclaimed as shown on Plate 4. Specifically, the following reclamation activities will be implemented at the end of mining activities:

(1) After the removal of all equipment, the shaft will be sealed in a manner approved by the appropriate regulatory agencies.

Action Taken:

All mining equipment, pumps, pipe, etc, was removed from the mine. Following equipment removal, the shaft was sealed as specified in the Behre Dolbear report which is on file with the ADEQ.

(2) All portions of the Area of Operations not previously reclaimed will be re-contoured and re-topsoiled. All remaining topsoil will be spread over the Area of Operations and contoured.

Action Taken:

All portions of the Area of Operations not previously reclaimed were re-contoured and re-topsoiled with the exception of a small area located where the Hermit Mine surface containment pond was located. Provided the Land Manager (BLM) authorizes this area for the borrowing of material to be used for reclamation of the nearby Kanab North Mine site in the future, and to provide a suitable stock tank for the cattle ranch permittee, IUSA will defer reclamation of the excluded area at this time. However, if the Land Manager does not agree to authorize IUSA to utilize this area for borrow material at a later date and to build a stock tank, this area will be reclaimed according to the Plan of Operations.

(3) All ground surface which has been disturbed will be drill seeded using a seed mixture approved by the BLM prior to application.

Action Taken:

All ground surface area which had been disturbed, was drill seeded using the following seed mixture as specified in the Decision Record for the Hermit Uranium Mine, approved June 8, 1987:

Fourwing saltbush	**2.0 lb./acre**
Indian ricegrass	**2.0 lb./acre**
Sand dropseed	**0.5 lb./acre**
Yellow sweet clover	**0.5 lb./acre**

When will this be provided? Do we need to process a letter of closure? Amount of waste shipped?

Pubescent Wheatgrass	**2.0 lb./acre**
Russian Wildrye	**2.0 lb./acre**
TOTAL	**9.0 lb./acre**

(4) The Area of Operations will be radiometrically surveyed and any material found which exceeds acceptable radiation standards will be either buried in the mine workings or removed from the site.

Action Taken:

Soils within the disturbed area, upon completion of earthwork and recontouring, were sampled and evaluated for radiological conditions. A natural radiometric background of 10 - 15 micro R/hour in gamma emanation occurs throughout non-anomalous areas of the Arizona Strip District. A 150 micro R/hour gamma emanation level was achieved on the site during reclamation. This level is considered a satisfactory target when working in areas where there is anomalous mineralization. During reclamation/earthwork, a sample grid was established on 50-foot spacings to verify soil condition. Areas that demonstrated gamma scintillometer readings exceeding 150 micro R/hour were excavated and that material was shipped to the White Mesa Uranium Mill located near Blanding, Utah, and processed. A copy of the reclamation radiometric survey map will be forwarded under separate cover.

(5) The diversion channels built at the start of the Project will be kept in place so as to divert surface run-off around the area of reseeding until revegetation has been adequately established. Thereafter, if requested by the BLM, these channels will be re-contoured and seeded.

Action Taken:

This site lies in a broad, very gentle sloping depression, approximately 1 mile in diameter and only minor surface drainage passes through the area. During heavy rainfall storm events (100 year), the majority of water is absorbed in the soil, or contained within several shallow depressions within the regional (1 mile diameter) depression. Therefore, during site reclamation the diversion channels were graded to meet the surrounding natural land topography and seeded according to the Land Manager (BLM) requirements.

(6) Sediments accumulated in the holding pond, if any, will be scalped from the pond and either hauled from the Project Area or disposed of underground in the mined out workings.

Action Taken:

During reclamation of the water holding pond, accumulated sediment was scalped and loaded onto trucks which delivered the same to the White Mesa Uranium Mill, located near Blanding, Utah; the material (sediment) was thereafter sent to process for uranium recovery.

(7) The potential usefulness of the water well will be evaluated as part of final site reclamation. If there is no other use for the well, it will be sealed and abandoned.

Action Taken:

During the Post-Mining Monitoring Period the monitoring well will be maintained in compliance with GWPP # G-0035-08 stipulations while also providing water to the cattle ranch permittee. Upon conclusion of the Post-Mining Monitoring Period, the water well will be sealed or conveyed to the Land Manager (BLM) for continued use by the cattle ranch permittee.

If the well is sealed, it will be sealed in the following manner: Unless otherwise modified by the Land Manager (BLM), the Hermit Mine water supply well abandonment (plugging) will be conducted according to Arizona Administrative Code Article 8, Section R-12-15-816. After the notice of intent to abandon the well is authorized, a full column of Portland cement grout will be pumped into the well to an elevation 20 feet below the land surface; the remaining open hole will be filled with soil. Work will be overseen by an Arizona State licensed well driller. The water storage tank and pump equipment will be removed from the site. Also, the well collar concrete foundation will be disposed at an authorized solid waste landfill site.

(8) The access road used for site access and haulage will be fully reclaimed unless the BLM requests that it be left in place as part of the regional road system under the jurisdiction of the BLM.

Verbal or Written? Please provide

Action Taken:

The Land Manager (BLM) advised IUSA that the site access and haulage road (1 mile in length) is to be left in place, providing access to the cattle ranch permittee corral facility.

3. Following the expiration date of this permit, the permittee shall continue monitoring listed in Part II.B.1.c. on a quarterly basis. In the event that a Maximum Groundwater Limit as described in Part II.B.2.b. is confirmed to be exceeded, the permittee shall immediately notify the Department and, within 30 days of such a violation, submit a plan to mitigate the effects of the violation.

Part II.B.1.c Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

The operator shall continue to monitor the water sampling/monitoring well, Division of Water Resources Well Registry No. 55-51877 semiannually during a minimum period of fifteen (15) years for the parameters in Part II.B.2.b. The Maximum Groundwater Limits shall be those calculated for Phase II (mining) groundwater monitoring.

Action Taken:

Based on discussions during the November 10, 1998 meeting between the ADEQ and IUSA, the on going monitoring during the post-mining phase can possibly be reduced or terminated completely. The monitor well has been monitored on a semi-annual basis for the past 8 years, without significant variations in the constituent values being observed. The monitoring period exceeds what is considered an acceptable time requirements of 12-quarters to establish baseline water quality. Therefore, after ADEQ's acceptance of the closure for the Hermit Mine, IUSA will prepare a formal request for review of the post-mining monitoring program frequency, for possible termination of further monitoring requirements.

4. In the event of abandonment, the septic tank shall have the sewage removed therefrom and be completely filled with earth, sand, gravel, or concrete. The top cover over the septic tank shall be removed before filling and the filling shall extend to the level of the top of the ground.

Action Taken:

During mine site reclamation, sewage from the septic tank was pumped out and properly disposed by a local contractor. Prior to backfilling the septic tank, the cover was removed and the tank was filled with broken concrete, dirt and native rock, thereafter the excavation was back filled flush with the surrounding ground surface.

CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME AND OFFICIAL TITLE: Earl E. Hoellen, President

SIGNATURE: _____ TITLE: President

DATE SIGNED: 14 December 1998

File Divider Page

100299

HERMIT MINE CLOSURE REPORT

DECEMBER 18, 1998

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
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003

WATER PERMITS
DEC 24 1998
RECEIVED

HERMIT MINE CLOSURE REPORT

DECEMBER 18, 1998

Submitted by:

International Uranium (USA) Corporation
Independence Plaza, Suite 950
1050 Seventeenth Street
Denver, Colorado 80265

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

HERMIT MINE
CLOSURE REPORT

GROUNDWATER PROTECTION PERMIT NO. G-0035-08

D. CLOSURE/POST CLOSURE

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ACTION TAKEN:

At the cessation of mining operations, the operator implemented the closure plan as referenced in the approved Plan of Operations. The individual requirements listed in the Plan of Operations are identified and discussed below under VII. "Measures to Reclaim at the End of the Operations".

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(4) The Area of Operations will be radiometrically surveyed and any material found which exceeds acceptable radiation standards will be either buried in the mine workings or removed from the site.

Action Taken:

Soils within the disturbed area, upon completion of earthwork and recontouring, were sampled and evaluated for radiological conditions. A natural radiometric background of 10 - 15 micro R/hour in gamma emanation occurs throughout non-anomalous areas of the Arizona Strip District. A 150 micro R/hour gamma emanation level was achieved on the site during reclamation. This level is considered a satisfactory target when working in areas where there is anomalous mineralization. During reclamation/earthwork, a sample grid was established on 50-foot spacings to verify soil condition. Areas that demonstrated gamma scintillometer readings exceeding 150 micro R/hour were excavated and that material was shipped to the White Mesa Uranium Mill located near Blanding, Utah, and processed. A copy of the reclamation radiometric survey map will be forwarded under separate cover.

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This site lies in a broad, very gentle sloping depression, approximately 1 mile in diameter and only minor surface drainage passes through the area. During heavy rainfall storm events (100 year), the majority of water is absorbed in the soil, or contained within several shallow depressions within the regional (1 mile diameter) depression. Therefore, during site reclamation the diversion channels were graded to meet the surrounding natural land topography and seeded according to the Land Manager (BLM) requirements.

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Action Taken:

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(7) The potential usefulness of the water well will be evaluated as part of final site reclamation. If there is no other use for the well, it will be sealed and abandoned.

Action Taken:

During the Post-Mining Monitoring Period the monitoring well will be maintained in compliance with GWPP # G-0035-08 stipulations while also providing water to the cattle ranch permittee. Upon conclusion of the Post-Mining Monitoring Period, the water well will be sealed or conveyed to the Land Manager (BLM) for continued use by the cattle ranch permittee.

If the well is sealed, it will be sealed in the following manner: Unless otherwise modified by the Land Manager (BLM), the Hermit Mine water supply well abandonment (plugging) will be conducted according to Arizona Administrative Code Article 8, Section R-12-15-816. After the notice of intent to abandon the well is authorized, a full column of Portland cement grout will be pumped into the well to an elevation 20 feet below the land surface; the remaining open hole will be filled with soil. Work will be overseen by an Arizona State licensed well driller. The water storage tank and pump equipment will be removed from the site. Also, the well collar concrete foundation will be disposed at an authorized solid waste landfill site.

(8) The access road used for site access and haulage will be fully reclaimed unless the BLM requests that it be left in place as part of the regional road system under the jurisdiction of the BLM.

Action Taken:

The Land Manager (BLM) advised IUSA that the site access and haulage road (1 mile in length) is to be left in place, providing access to the cattle ranch permittee corral facility.

3. Following the expiration date of this permit, the permittee shall continue monitoring listed in Part II.B.1.c. on a quarterly basis. In the event that a Maximum Groundwater Limit as described in Part II.B.2.b. is confirmed to be exceeded, the permittee shall immediately notify the Department and, within 30 days of such a violation, submit a plan to mitigate the effects of the violation.

Part II.B.1.c Phase III - Post-Mining

The purpose of monitoring during the post-mining phase is to determine the effectiveness of the closure activities.

The operator shall continue to monitor the water sampling/monitoring well, Division of Water Resources Well Registry No. 55-51877 semiannually during a minimum period of fifteen (15) years for the parameters in Part II.B.2.b. The Maximum Groundwater Limits shall be those calculated for Phase II (mining) groundwater monitoring.

Action Taken:

Based on discussions during the November 10, 1998 meeting between the ADEQ and IUSA, the on going monitoring during the post-mining phase can possibly be reduced or terminated completely. The monitor well has been monitored on a semi-annual basis for the past 8 years, without significant variations in the constituent values being observed. The monitoring period exceeds what is considered an acceptable time requirements of 12-quarters to establish baseline water quality. Therefore, after ADEQ's acceptance of the closure for the Hermit Mine, IUSA will prepare a formal request for review of the post-mining monitoring program frequency, for possible termination of further monitoring requirements.

4. In the event of abandonment, the septic tank shall have the sewage removed therefrom and be completely filled with earth, sand, gravel, or concrete. The top cover over the septic tank shall be removed before filling and the filling shall extend to the level of the top of the ground.

Action Taken:

During mine site reclamation, sewage from the septic tank was pumped out and properly disposed by a local contractor. Prior to backfilling the septic tank, the cover was removed and the tank was filled with broken concrete, dirt and native rock, thereafter the excavation was back filled flush with the surrounding ground surface.

CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME AND OFFICIAL TITLE: Earl E. Hoellen, President

SIGNATURE: _____ TITLE: President

DATE SIGNED: 14 December 1998

File Divider Page

HERMIT

#100299



EA No. AZ-010-87-013

THE HERMIT PROJECT
DRAFT ENVIRONMENTAL ASSESSMENT

A Major Modification to the Hunt Project
Plan of Operations for Uranium Ore Extraction

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

4.7.87

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
March 3

Bureau of Land Management
PUBLIC LANDS ☆USA☆
USE ☆ SHARE ☆ APPRECIATE

IN REPLY REFER TO:

United States Department of the Interior

3800 (015)

BUREAU OF LAND MANAGEMENT
ARIZONA STRIP DISTRICT OFFICE
196 E. Tabernacle St.
St. George, Utah 84770

APR 7 1987

We are pleased to send you the enclosed DRAFT Environmental Assessment (DEA) for the Hermit Mine Proposal. This DEA was written in response to a Plan-of-Operations submitted by Energy Fuels Nuclear, Inc. (EFN) on March 9, 1987. In addition to the proposal, the DEA evaluates several alternatives that propose various modifications to the Plan, including the No Action Alternative.

In preparing the DEA, outside consultants were used to assess the existing environment and the anticipated environmental impacts to Air Quality, Radiation, Ground Water and Surface Hydrology. While we have attempted to summarize these studies in the DEA, for the readers convenience, these studies are available on a limited basis at the Arizona Strip District Office (phone: (801) 673-3545).

A response, preferrably in writing, on the DEA will be required in order for you to remain on our active minerals mailing list. Comments are due by May 7, 1987 in order for them to be incorporated into the Final Environmental Assessment. The Bureau will target June 7, 1987 for making a decision on the proposal. If you wish to be notified about the decision, please make that request with your submission.

"HERMIT"
Arizona Strip District
Bureau of Land Management
196 East Tabernacle
St. George, UT 84770

Sincerely,

G. William Lamb
District Manager

Enclosure

APR 1987
RECEIVED
WATER PERMITS
UNIT

D R A F T

HERMIT PROJECT

EA No. AZ-010-87-013

A Major Modification to the Hunt Project
Plan of Operations for Uranium Ore Extraction
AS-010-82-24P/Amended, The Hermit Mine

April 7, 1987

HERMIT PROJECT

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EA No. AZ-010-87-013

ENVIRONMENTAL ASSESSMENT

A Major Modification to the Hunt Project Plan of Operations for Uranium Ore Extraction AS-010-82-24P/Amended, The Hermit Mine

I. INTRODUCTION

Energy Fuels Nuclear, Inc. (EFN) has submitted a major modification to the Hunt Properties (Site No. 77), 82-24P(A), an existing Exploration Plan of Operations. The purpose of the modification is to allow EFN to expand the nature and duration of its presently authorized activities to include ore extraction activities pursuant to 43 CFR 3809 regulations and BLM 3809 Manual.

The existing exploration plan was submitted on May 17, 1982 and included a moderately intensive geochemical soil sampling program. The plan was subsequently approved after a review during which the BLM prepared a Decision Record based on an Environmental Analysis to determine site-specific impacts, reasonable alternatives and appropriate mitigation to limit conflicts and prevent undue or unnecessary degradation (June 23, 1982). Three separate minor addendums (7/23/82, 7/29/85 and 8/12/85) were submitted to pursue more strategic drilling.

Until a decision is made on this proposal, all work conducted must be in accord with the approved plan of operations. If the modification is approved, the existing plan of operations will be superceded in all respects.

To date, approximately 40 holes have been drilled, the majority of which are shallow soil samples. Minor road maintenance of the existing road has been allowed. No new permanent access has been constructed. There are approximately 3 acres of disturbance within an approximate 10-acre area.

II. PURPOSE AND SCOPE OF ENVIRONMENTAL ASSESSMENT

Pursuant to the Code of Federal Regulations (CFR), 43, Subpart 3809 (Surface Management), the Federal Land Policy and Management Act (FLPMA) and National Environmental Policy Act (NEPA), the purpose of this Environmental Assessment (EA) is to evalutate if the proposed action can take place in a manner that will prevent unnecessary or undue degradation and provide protection of non-mineral resources on federal lands.

The EA will include within its scope an evaluation of the proposed plan of operations to determine if it will be implemented so as to prevent undue and necessary degradation, while providing for reasonable reclaimation and reasonable protection of the non-mineral resources on Federal lands.

This E.A. is also the vehicle the Bureau will use to determine if there is a potential for significant adverse environment impacts and if so, if an Environmental Impact Statement is warranted.

This EA will also be used to assess the potential environmental impacts of the proposed modification and to identify if feasible or reasonable alternatives exist to reduce those impacts. In addition the EA will be used to assess mitigating measures that could be proposed to further prevent undue and unnecessary degradation pursuant to 43 CFR 3809, FLPMA and BLM 3809 Surface Management Manual.

III. PROPOSED ACTION AND ALTERNATIVES CONSIDERED

A. Proposed Action - General

Operator: Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

Claimant: Energy Fuels, Ltd.
(Same Address)

Claim Name: Hunt 533-537

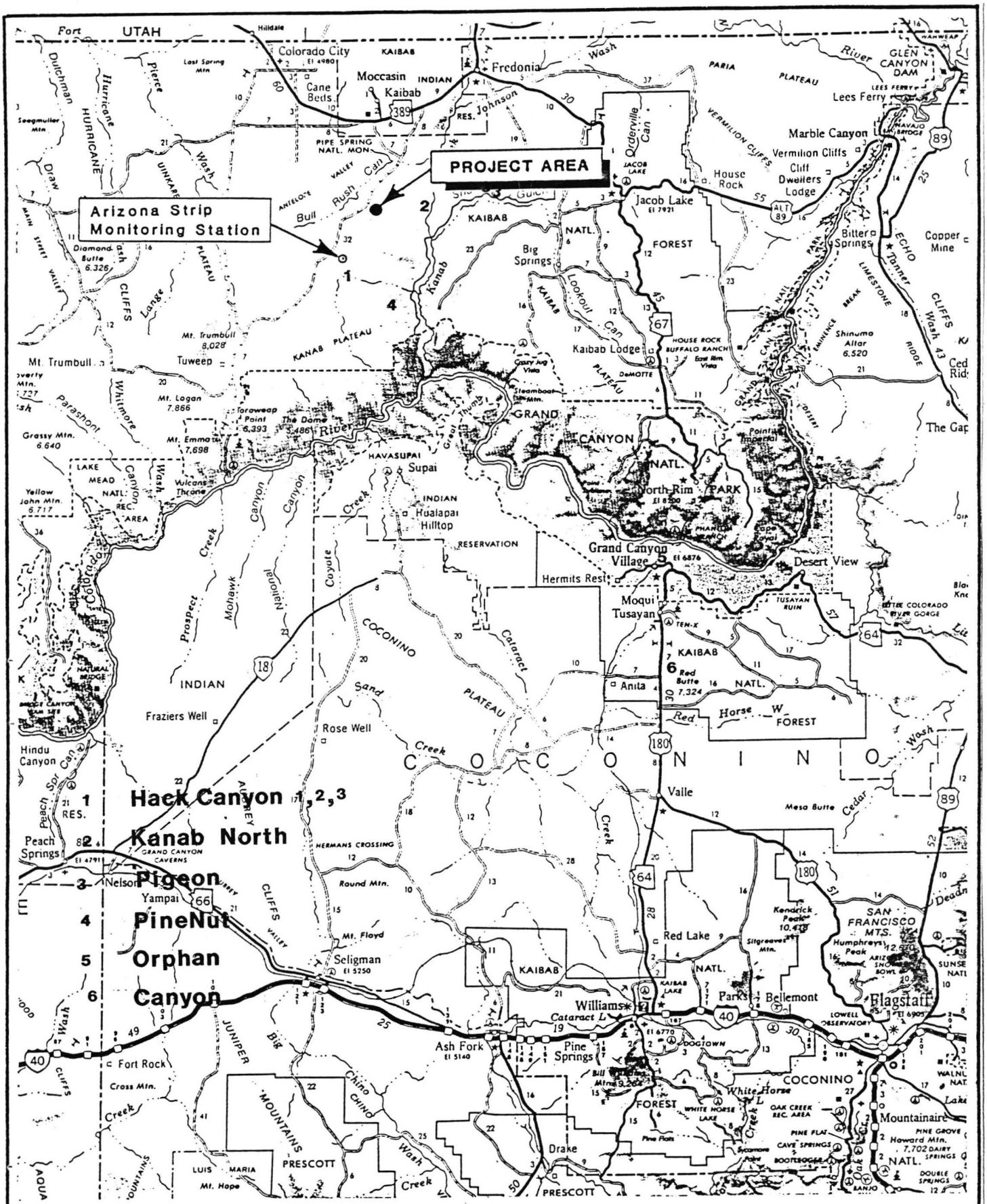
BLM No.: AMC 150856-150861

Local Office: Energy Fuels Nuclear, Inc.
P. O. Box 36
Fredonia, AZ 86022

Location: T38N, R4W, Sec. 17, SW¼, G&SRM (see Figures 1, 1b & 2)

The development and mining of the Hermit deposit will be conducted in two phases. The first phase will involve initial site preparation and shaft sinking activities, followed by underground evaluation, development and production during which ore recovery will occur.

Initial underground evaluations will be conducted by sinking a shaft approximately 1,100 feet below the surface adjacent to the deposit and then extending horizontally into the ore body. Once access to the ore body has been established in Phase I, extensive underground drilling and sampling will be done to more fully define the extent and mining grade of the deposit.

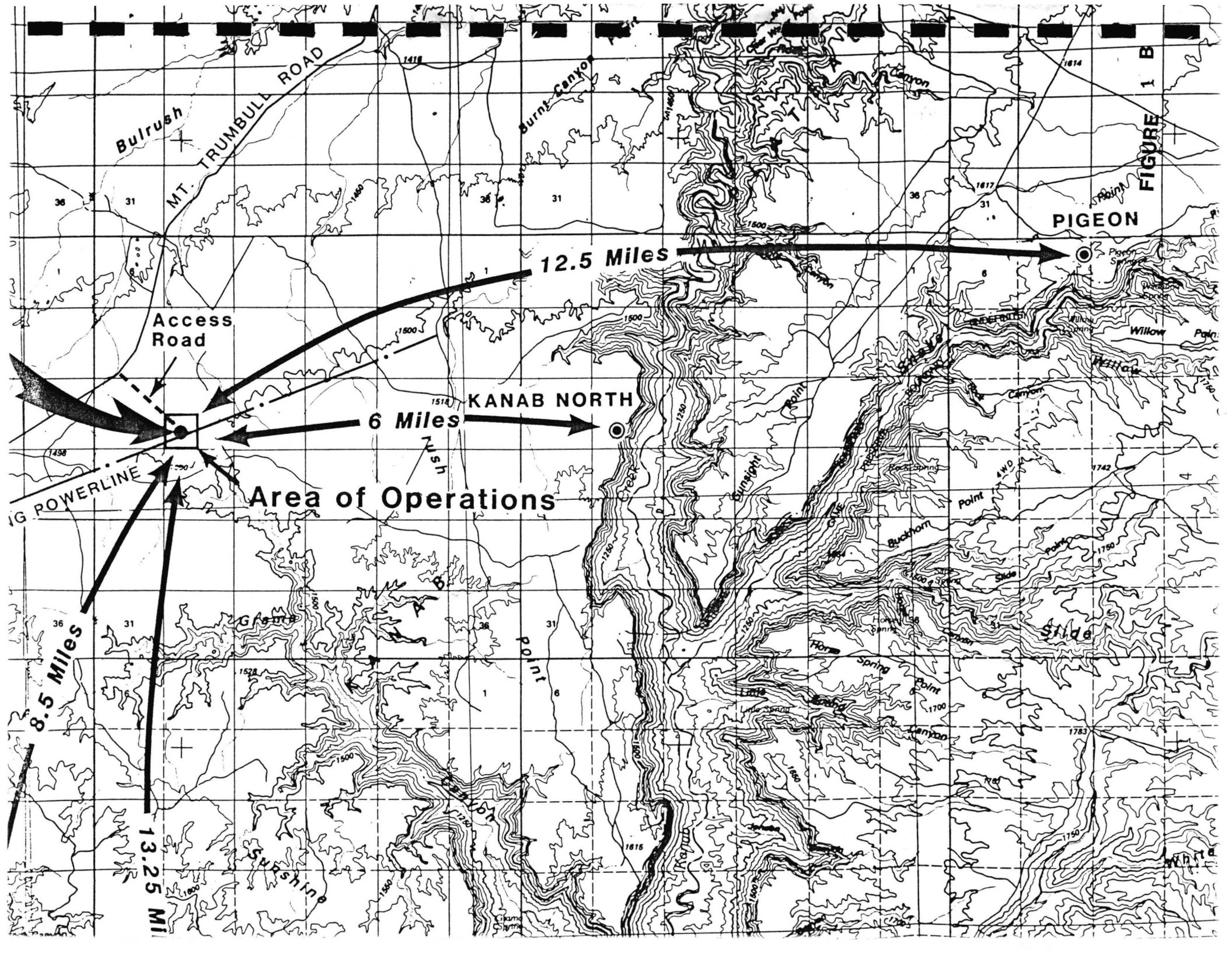


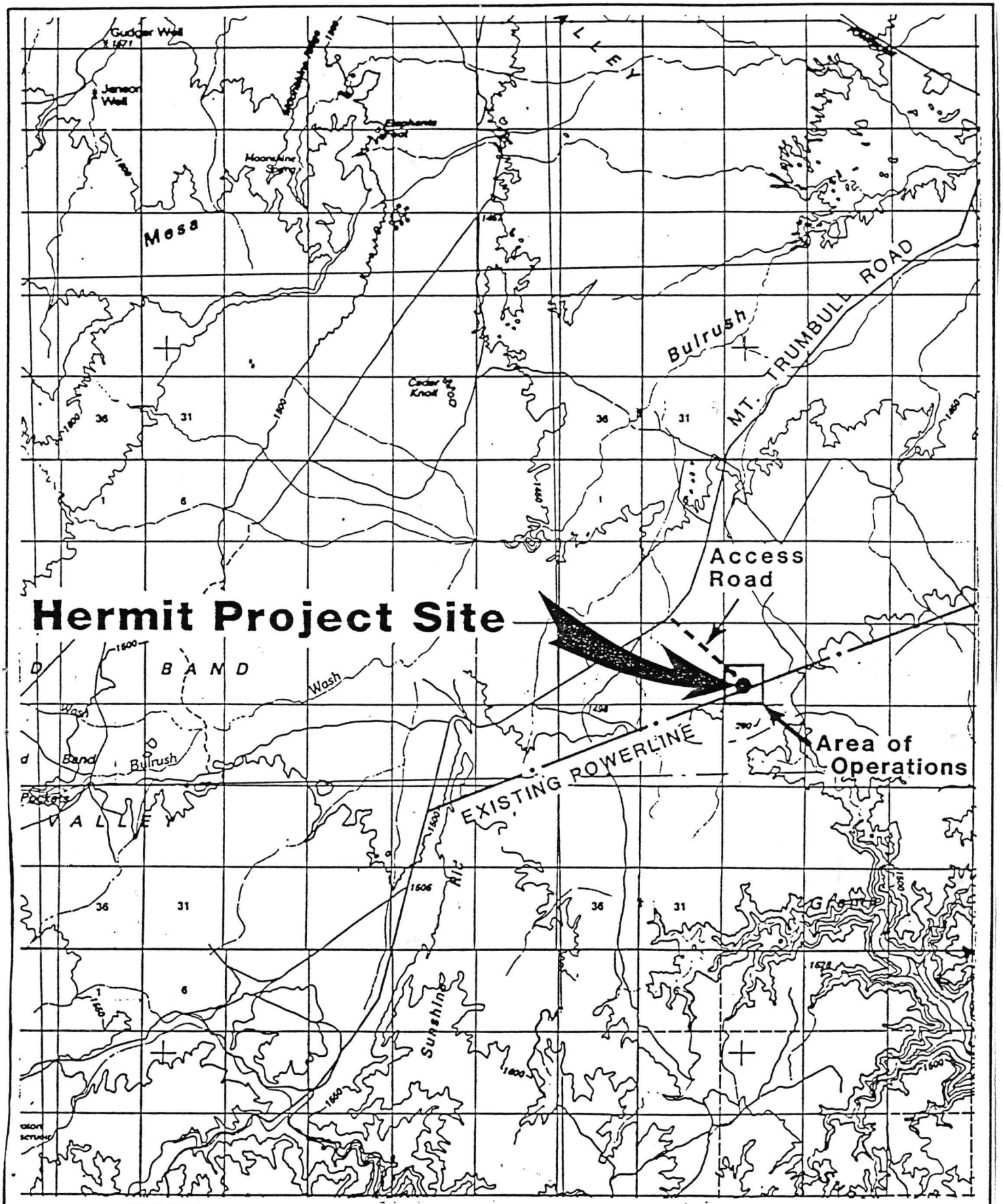
EnecoTech

PROJECT **Hermit**

Location Map

FIGURE 1


FIGURE 1 B
MT. TRUMBULL ROAD
Bulrush
Burnt Canyon
PIGEON
12.5 Miles
Access Road
KANAB NORTH
6 Miles
Area of Operations
POWERLINE
8.5 Miles
13.25 Mi
Kanab Creek
Point
Slide
Spring
Canyon
Wash
Creek



ENECOTECH
Denver, Colorado

PROJECT Hermit

LOCAL MINE AREA

FIGURE 2

During the site preparation and shaft sinking phase, surface facilities will be limited to those necessary to facilitate shaft sinking activities. Because of the proximity of the project area to an existing powerline, this phase of activities will be supported by permanent electric power. During initial site preparation and shaft sinking activities, no uranium ore will be encountered. In addition, until completion of the underground evaluation and development activities, it is anticipated that ore production will not exceed a few thousand tons, an amount sufficient for complete bulk sampling of the ore body. Moreover, it is not anticipated that any uranium ore will be encountered until sometime during the second year of activities at the Project Area. Prior to this time, site preparation activities on the surface and shaft sinking activities will not involve the movement or storage of uranium ore on the surface. During the first phase, EFN proposes to add 1.2 miles of new access road.

Once significant ore production activities begin in the second phase of activities, approximately three years after site preparation activities begin, the surface facilities will be expanded as necessary to complete underground development of the ore body and the full mining and extraction of the mineral reserves. During this development and mining phase, further upgrading of the new access road is planned so ore haulage can be safely undertaken.

As a uranium producer, EFN is currently engaged in various phases of site preparation, shaft sinking, underground development, mining or reclamation activities at five mines north of the Grand Canyon. (see Figure 1b). It has recently closed or is in the final stages of mining at the three Hack Canyon Mines (8 miles south of the Hermit Project). Site reclamation activities at the three mines will begin during the second quarter of 1987.

At the Pigeon Mine (12.5 miles northeast of the Hermit Mine), site preparation and shaft sinking began in 1982, with underground drilling, evaluation and development activities continuing until mid-1984 when full mining began. Mining activities at the Pigeon Mine are expected to continue until 1990 (the time when commercial ore production at the Hermit project is expected to commence) when site reclamation will commence.

At the Kanab North Mine (6 miles east of the Hermit Mine) site preparation and shaft sinking activities did not begin until 1985. At the present time, EFN has completed its shaft sinking activities at the Kanab North Mine, and is proceeding with its underground drilling, evaluation and development work. Significant ore production from Kanab North is not expected until 1988 or 1989.

Finally, site preparation and shaft sinking activities at the Pinenut Mine (13.25 miles south of Hermit Mine) began in mid-1986. At present, site preparation for the first phase of activities has been completed and shaft sinking activities have just begun. Significant ore production from the Pinenut Mine is not expected until 1989 or 1990.

It is apparent from the description of the status of activities at other locations where EFN is operating that by the time Hermit Mine is sufficiently developed to enable EFN to produce significant quantities of ore from the project, ore production from the 3 Hacks Canyon Mines and Pigeon Mine will have been completed.

Access to the project area from Fredonia, Arizona is achieved by traveling southwest on State Highway 389 eight miles to Mt. Trumbull Road. After proceeding 11 miles south on Mt. Trumbull Road, a southeast side road is taken 1.2 miles to the project area.

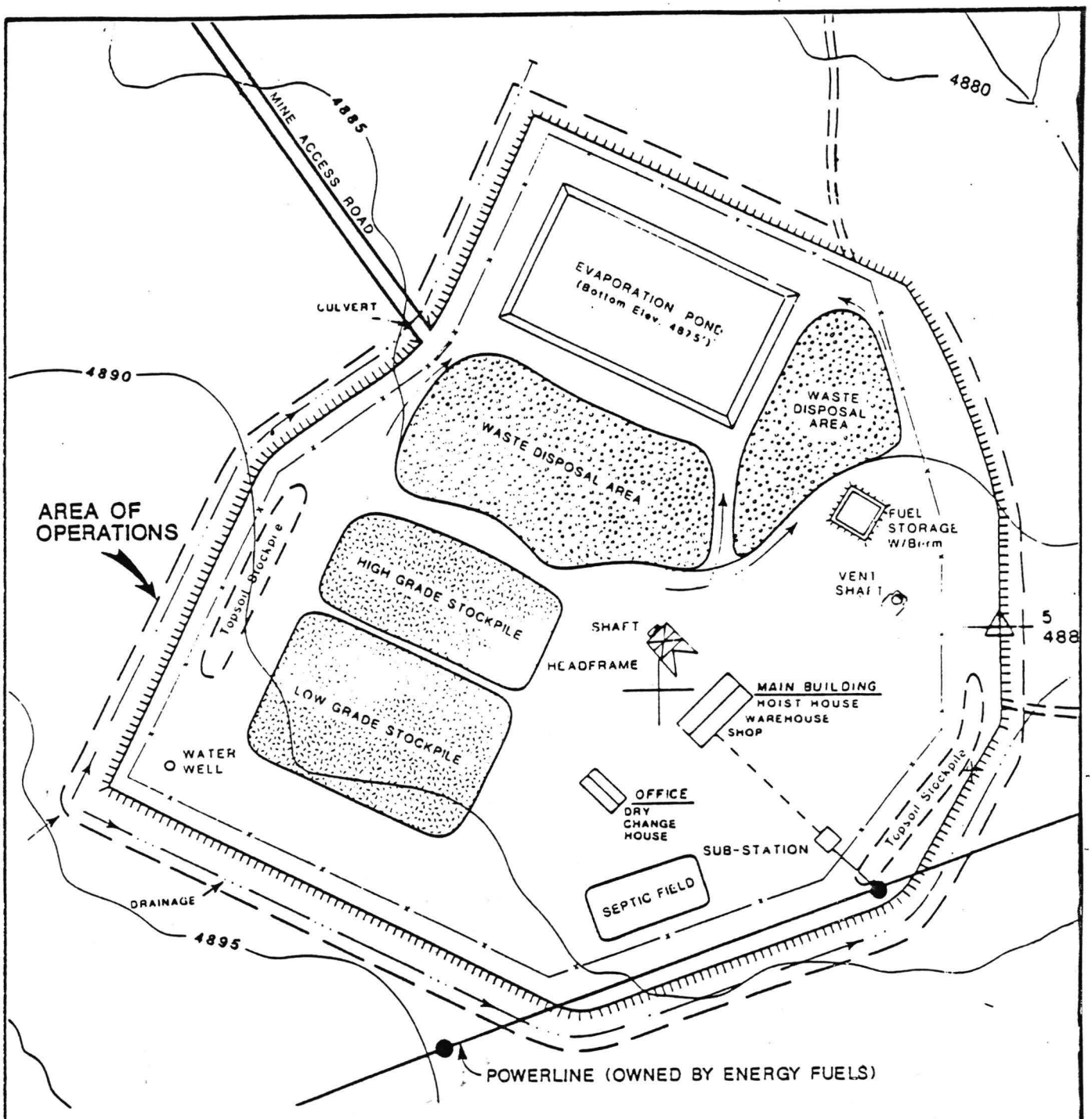
Proposed Action - Specifics

PLANNED OPERATIONS:

During the next several years, EFN plans to develop and mine the uranium deposit located in the project area by underground mining methods in two distinct phases of operations.

Based upon its experience with similar deposits, EFN expects its site preparation, shaft sinking, underground drilling and development, and mining and reclamation activities to be completed in approximately ten (10) years. Access to the deposit will be by a conventional, two and one-half compartment, vertical shaft located immediately southwest of the deposit. The shaft will be excavated to a depth of approximately 1,100 feet below the surface. As the vertical shaft is sunk, horizontal workings will be driven at various levels toward the deposit. Thereafter, two to four underground drilling chambers will be excavated in or near the deposit. From these chambers, underground drilling will be undertaken to further define the full extent of the deposit. Portions of the workings within the deposit and the underground drilling will provide EFN with adequate information to determine the most efficient mining sequence to ensure maximum recovery of the mineral reserve. The proposed shaft location, surface facilities, shaft and waste rock disposal area are identified on Figures 3 & 4.

During site preparation, shaft sinking and underground drilling and evaluation, employment will range from 12 to 22 personnel. Shaft sinking generally is conducted on a three-shift, seven day per week schedule. A two-shift, five day per week schedule is probable during underground drilling and development activities. During this initial phase, a majority of the employees will be skilled shaft

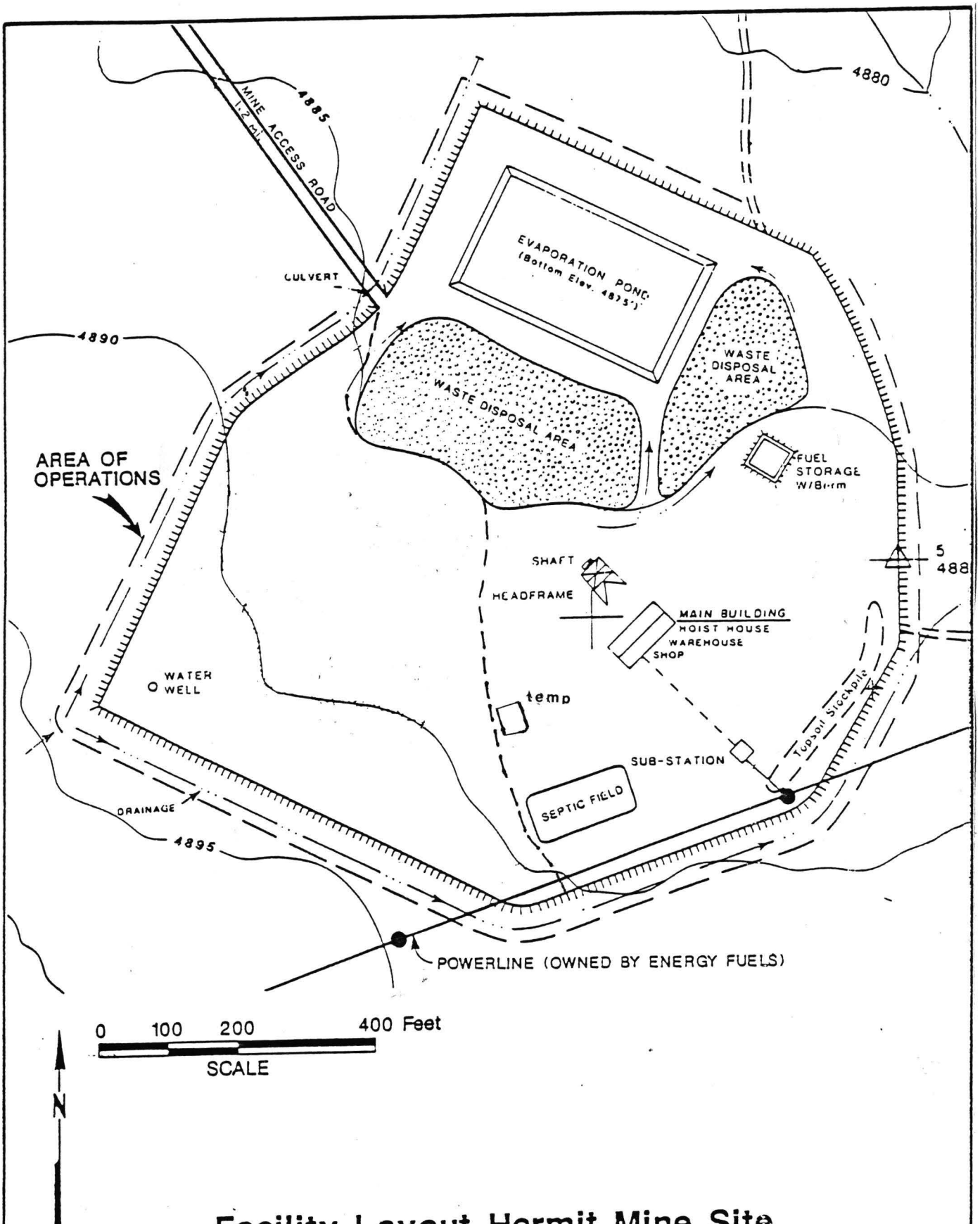


Facility Layout Hermit Mine Site

PHASE ONE

FIGURE 3

Dames & Moore



Facility Layout Hermit Mine Site

PHASE TWO

FIGURE 4 **Dames & Moore**

miners, transferred from nearby mines presently operated by EFN or contractors hired locally. Little or no influx of new personnel to the area is expected.

Once the initial underground drilling program has satisfactorily confirmed the full extent and dimensions of the ore deposit, horizontal workings will then be driven from the lowest portion of the shaft, beneath the deposit to a point just outside the farthest extent of the ore reserve. From this point, an eight-foot diameter, vertical ventilation shaft will be upreamed to the surface utilizing a pilot hole to intersect the lowest workings. This second (ventilation) shaft will exhaust air, thereby creating adequate airflow through- out the mine workings, and, in addition, providing a second exit or escapeway from the mine in the event of an emergency.

Raise or incline workings within the mine will connect the various levels within or very near the deposit. At various elevations from these levels, sublevel workings will be driven to extract ore from the deposit. The broken ore will be dropped down raises, designed for such use, to drawpoints on the lowest level. The ore will then be hauled to the shaft, at which point it will be transferred to skips in the shaft and hoisted to the surface. Barren waste rock generated during shaft sinking, development and mining will be removed and disposed of on the surface in the waste disposal areas, to the extent that such material cannot be utilized for road maintenance or construction of the mine yard. Ore will be stock-piled on the surface near the shaft until shipment to the Blanding mill takes place.

After development work is completed (approximately three years after start-up), the mine will be operated at an average production rate of 300 tons per day for approximately five years. It is hoped that planned underground drilling will increase the tonnage to be mined and, consequently, extend the operation's life by a few years. However, experience to date at other operations suggests that a production phase significantly longer than five (5) years is unlikely.

Employment during the first few years of underground development will range from 15 to 30 personnel. As production capacity grows, employment could reach approximately 40 personnel at the 300 ton-per-day rate, working two shifts per day.

Most employees are expected to be drawn from existing residents of the area. Moreover, it is hoped that the work force will consist of employees currently working at the Hack Canyon and Pigeon Mines. Since these mines will have ceased operations by the time the production phase of the Hermit Project begins, EFN would plan appropriate transfers, if timing permits. EFN will provide and operate buses to transport employees to and from the Project Area.

Driving of individual vehicles is discouraged. Management and technical staff support will be based at the Fredonia Mine Operations office.

AREAS TO BE DISTURBED:

There are two specific areas that will be temporarily used or disturbed during the project life: (1) the Area of Operations with surface plant and rock disposal area (23.6 acres); and (2) 1.2 miles of access road (5.0 acres). The Area of Operations where all activities will take place, together with planned surface facilities, are shown on Figures 3 & 4. In designing the Plan of Operations, EFN has minimized the size of the Area of Operations as much as practicable to ensure adequate working area while minimizing disturbance. The locations of the shafts, office, hoist house, main building, waste rock storage area and ore stockpiles will all be generally located during each phase as shown on Figures 3 & 4. Of course, further engineering and unexpected problems encountered during construction could cause the actual layout to differ in minor detail from that shown on Figures 3 & 4. In any event, the surface impacts from the proposed operations will be unaffected by any necessary minor relocations within the Area of Operations.

During the first two to three years of the Project or during the underground evaluation phase, only the eastern half or 15-acre portion of the Area of Operations will be utilized. This initial yard is within the larger 23.6-acre Area of Operations to be occupied during the production phase. During the underground evaluation phase, only the shaft and sinking hoist area will be graded to a final yard elevation.

A water source of a few gallons per minute is needed for underground drilling and sanitation during the first phase of activities. Consequently, a water well will be drilled on the southwest edge of the Area of Operations to a depth of 2,000 to 2,500 feet. Tankage to hold water will be located near the site of the water well. In the area shown on Figure 4 at least two house trailers will be located during phase one which will serve as temporary lodging for the mine staff and a security guard as may be needed during phase one. No full-time resident other than a security guard is proposed.

Prior to construction of the mine yard, available topsoil from the initial areas to be disturbed will be removed and stored at the eastern edge of the Area of Operations (see Figure 3).

In addition, during phase two a second topsoil storage area will be created at the western edge of the Area of Operations (see Figure 4). These locations will assure that topsoil will not be disturbed

during mining activities. In addition, after construction of the water diversion facilities discussed below, the topsoil stockpiles will be protected from erosion due to surface runoff. The size and dimensions of the topsoil stockpiles will increase at the beginning of the production phase when additional topsoil is removed and stored prior to construction of the final mine yard.

During phase one, EFN proposes to relocate approximately 1.2 miles of access road as shown on Figure 3 so that access to the Project Area of equipment and personnel can be achieved with safety and minimal environmental impact. In order to avoid the addition of 1.2 miles of new roads to the BLM system, EFN proposes to reclaim fully the existing access road to the Project Area to BLM standards during phase one of activities, provided that such reclamation is acceptable to the BLM. In addition, upon completion of mining activities at the Project Area, the relocated access road would also be fully reclaimed unless the BLM requests that such access road be left intact as part of the BLM system.

During the first phase of activities, a temporary hoist to excavate the shaft will be located approximately 125 feet southeast of the shaft. A building will surround the temporary sinking hoist. The necessary air compressors, semi-trailers for shop, warehousing, office and showers will be located to the southeast of the temporary hoist building. Immediately south of the shaft, a septic field will be located to handle sewage from the showers and trailers located with the Area of Operations.

During initial development activities at the beginning of phase two only minimal ore is expected to be generated incidental to the underground evaluation and development activities. Specifically, EFN estimates that no more than a few thousand tons of ore will be generated during the underground evaluation and development phase of activities. This material will be stored at the location shown on Figure 4 until shipped to the Blanding mill for bulk sampling and amenability testing.

In order to ensure that no surface runoff from outside of the Area of Operations is allowed to enter, EFN will construct water diversion facilities on both the east, south and west perimeters of the Area of Operations as shown on Figures 3 & 4. Prior to the design of these surface water diversion facilities, it was necessary for EFN to analyze the watersheds involved and the potential of the area to experience severe storm events. Consequently, EFN retained the services of Dames & Moore, consulting hydrologists, to evaluate the surface runoff issues and to advise EFN regarding proper design, location and capacities for the diversion facilities. The surface water diversion facilities which EFN will construct will conform with the recommendations of Dames & Moore and will ensure that these facilities are capable of

diverting around the areas of disturbance the surface runoff resulting from at least a 100-year storm event. Importantly, this significant margin of safety will be achieved while making maximum use of the existing natural channels existing in the Project Area. The planned diversion facilities will be constructed during the first phase of activities and will be maintained throughout the life of the Project.

All rainfall which falls within the Area of Operations will be directed to and held in the surface water holding/evaporation pond shown in Figures 3 & 4. This pond will be lined with an artificial impervious material to insure that leakage does not occur. It will be constructed during phase one and will be sized to hold all water which may be encountered during mining activities as well as the surface drainage within the disturbed areas resulting from a 100-year 24-hour event.

After the deposit has been fully evaluated, as part of the next phase of activities the nature and extent of the surface facilities will be expanded as shown on Figure 4. Moreover, during this phase of activities the area of disturbance will be expanded to enable the efficient extraction of the ore reserve--including construction of ore stockpile areas and an additional topsoil stockpile. Finally, as these activities proceed, some additional access road upgrading activities will be necessary to accommodate the ore haulage needs of the mine--estimated to average 12 truck loads per day once full ore production is achieved.

Of course, prior to beginning the surface expansion activities, available topsoil within the additional disturbed areas will be collected and stored for use in final reclamation in the identified topsoil stockpile area.

Barren waste rock from excavation of the underground workings will either be used to build the relocated access roads, mine yard and stockpile areas to the required grade, or any excess will be disposed of in the area shown on Figure 4. This waste disposal area has the capacity to hold the expected barren waste rock to be generated without noticeable change to the original topographic appearance.

The largest and only major building in the surface plant will be the "main building" located as shown on Figure 4. This building will house the permanent hoist, air compressors, standby electric generator, shop warehouse and emergency medical facilities.

South of the main building, various supplies needed during the production phase will be stockpiled. Tankage for storage of gasoline and diesel fuel will be located as shown in Figures 3 & 4 in the area to the northeast of the main building.

Once the surface facilities needed during the production phase of activities have been installed, a six-foot chain link security fence with lockable gates will be erected to enclose the Project Area as noted on Figure 4. The mine-use area will be posted with "No Trespassing" signs. The gates in the security fence will be closed and locked during periods of inactivity at the mine site.

MEASURES TO LIMIT DISTURBANCE:

This Plan of Operations is designed to minimize disturbances to the environment and to provide for complete reclamation of the surface after completion of the mining activities to the standards required by law. The areas proposed to be disturbed are as compact as practicable with surface facilities and stockpile and disposal areas clustered together where feasible.

In the design of this Plan of Operations, EFN recognized that one of the important natural environmental issues at the site is proper handling of surface water runoff from adjacent watersheds. To address this issue, and to insure the integrity of the Area of Operations during activities, flood control measures have been built into the Plan of Operations consistent with the recommendations of an independent surface water hydrologist who evaluated the area. As designed, surface water cannot enter the Area of Operations from any direction. In addition, rainfall within the yard will be retained within the Area of Operations because of its internal drainage. In addition, the designed water holding/evaporation pond will be sized with sufficient capacity to retain the surface runoff which would be expected to fall within the disturbed area as a result of a 100-year, 24-hour storm event as well as any excess water encountered during mining activities which cannot otherwise be utilized in connection with ongoing activities.

Diversion channels to direct surface runoff around the Area of Operations will be constructed as one of the first activities. The small watersheds above the Area of Operations, approximately 200 acres, will flow into the diversion channels rather than into the Area of Operations.

The southwestern portion of the mine yard will be used to stockpile ore prior to shipment to the Blanding mill for processing. Prior to stock- piling ore grade material in the locations shown on Figure 4, EFN will construct an ore pad upon which all ore grade material will be stockpiled pending removal from the Project Area. Each ore pad will be at least one foot thick and shall be constructed utilizing a mixture of limestone and shale produced from the underground excavation at the Project Area. Experience at other facilities has confirmed that ore pads of this type are effective in preventing the movement of any mineral values into the soils below the ore pad during periods of ore storage.

All material containing more than 0.03% U_3O_8 will be temporarily stockpiled at the location shown on Figure 4. Approximately 65,000 tons of such low grade material will be produced during mining activities. If market prices increase, nearly all of this material will be shipped to the Blanding mill for processing before the close of mining activities. If any of this low grade material remains within the Project Area at the close of activities, prior to final reclamation, EFN will haul it from the site or dispose of it underground in the mined-out workings.

EFN will construct and maintain the access road from the Project Area to the Mt. Trumbull Road in conformance with BLM specifications. Ore haulage from the site will be by independent truck contractors using 25-ton capacity trucks which comply with Arizona Highway Department of Transportation requirements. To prevent loss of material from wind erosion and rough roads, each load will be covered with a tarpaulin lapping over the side about a foot and secured every few feet around the truck bed. In the event of a truck accident, EFN will take immediate aggressive action to clean up any spilled material.

MEASURES TO BE TAKEN DURING A PERIOD OF NON-OPERATION:

EFN intends to operate the Hermit Project until all economic ore reserves are exhausted. The federal regulations which require submittal of this Plan of Operations call for a statement of measures to be taken in the event of an "extended period of non-operation before mining is completed." While there is no definitive plan for a shutdown before exhaustion of the mineral reserve, this occurrence must be regarded as a possibility.

Two different types of scenarios would occur depending upon the anticipated length of non-operation. A short shut-down of a few months to a year would require only limited action. In this case, a few employees would be kept at the mine site for repair and maintenance work and a watchman would reside at the mine site. All inventory items that may deteriorate in a year's time, such as explosives, oil, gas and first-aid supplies, would be used or removed from the Project Area. Hardware, such as nuts, nails and pipe fittings, would be secured in place. All equipment would be checked and most of it stored in the shop building or in the mine workings. The limited amount of equipment that could be used at other EFN operations would be removed from the site. All stockpiles above economic grade would be shipped to a mill for processing. There would likely be some stockpile of low grade ore which would be maintained at the mine site during a shutdown. Ventilation fans, electric lines and transformers would be left in place. Steel gates on the mine shaft would be closed and locked.

In the event of non-operation for more than a year, a different procedure would be followed. Nearly all mobile equipment and a portion of the fixed equipment would be removed from the Project Area. Fans would be removed and the ventilation shaft capped with perforated steel plates welded in place to allow natural ventilation but to prevent access to the workings. The buildings, headframe and hoist would be left in place but secured and maintained in the same manner as a short term closure.

MEASURES TO RECLAIM AT THE END OF THE OPERATIONS:

At the conclusion of mining activities, EFN will disassemble and remove the hoist/shop building and bury all concrete footings and concrete slab materials within the mine yard or backfill the material into the shaft. All facilities, materials, supplies and equipment will be removed. Low grade material will be removed from the site or backfilled into the mine shaft. The shaft entrance will be sealed to prevent entry by unauthorized members of the public, and the entire Area of Operations will be fully reclaimed. Specifically, the following reclamation activities will be implemented at the end of mining activities:

(1) After the removal of all equipment, the shaft will be sealed in a manner approved by the appropriate regulatory agencies.

(2) All portions of the Area of Operations not previously reclaimed will be re-contoured and re-topsoiled. All remaining topsoil will be spread over the Area of Operations and contoured.

(3) Sediments accumulated in the holding pond, if any, will be scalped from the pond and either hauled from the Project Area or disposed of underground in the mined out workings.

(4) The Area of Operations will be radiometrically surveyed and any material found which exceeds acceptable radiation standards will be either buried in the mine workings or removed from the site.

(5) The diversion channels built at the start of the Project will be kept in place so as to divert surface runoff around the area of reseeding until revegetation has been adequately established. Thereafter, if requested by the BLM, these channels will be recontoured and seeded.

(6) All ground surface which has been disturbed will be drill seeded using a seed mixture approved by the BLM prior to application.

(7) The potential usefulness of the water well will be evaluated as part of final site reclamation. If there is no other use for the well, it will be sealed and abandoned.

(8) The access road used for site access and haulage will be fully reclaimed unless the BLM requests that it be left in place as part of the regional road system under the jurisdiction of the BLM.

PROPOSED RADIOLOGICAL MONITORING PROGRAM:

The proposed radiological monitoring program involves collection of appropriate data before the mine is operational. Additional measurements will be made as needed during mine operation and in the event of an accidental release of radioactivity to the wash. A final survey will be conducted at the time the mine is closed. Each part of the monitoring program is described below:

(1) **Preoperational Baseline Information:** The preoperational baseline data collection program will last one year and will involve background measurements of direct gamma radiation, radon gas and progeny concentrations, and radioactivity concentrations in air and soil.

Direct gamma radiation measurements are being obtained on a quarterly basis by at least two independent monitoring devices and at a minimum of 4 locations. Passive thermoluminescent dosimeters will provide cumulative dose information. Readings from a pressurized ion chamber and/or two micro-R scintillometers will be recorded whenever the thermoluminescent dosimeters are exchanged. The entire Radiological Assessment of the Hermit project is located in the Appendix of this document.

Quarterly radon concentration measurements are being made at the 4 sites using Terradex alpha track-etch detectors. The first measurements are reported in the Appendix. Passive radon measurements are also being made at the Pinenut, Pigeon, Kanab North and Canyon Mine Sites. Data can be used to determine the local variations in radon concentrations and to monitor for any cumulative impacts from the increased uranium mining activities.

A water sample has been collected from the stock tank located near the proposed mine site. Radionuclide assay for baseline data is in progress.

Water samples from Kanab Creek (DM 85) and the Colorado River (McK 86) have been analyzed and may be used to monitor changes in radioactive material concentrations. However, as a result of variations in water flow rates (dilution factors) and

leaching of ore from the many exposed deposits which are located around the Arizona Strip, Grand Canyon, and the Little Colorado River, no noteworthy manmade increases should be anticipated.

A soil sample has been collected from an area downslope from the site. It will be assayed specifically for Ra-226 and gamma spectrometry performed to determine baseline concentrations of Th-232, Tl-208, K-40, and Cs-137 (from fallout).

Passive dust samples have been collected at the four monitoring sites to obtain background information on the amount of natural radioactivity in the dust around the mine.

(2) Operational Measurements: The quarterly thermoluminescent dosimetry measurements and scintillometer measurements will continue at the four established monitoring sites. Pressurized ion chamber measurements will be performed at least once per year to confirm the thermoluminescent dosimetry and scintillometer readings. Additional sites may be established at the mine and along the haulage route as deemed necessary.

Based on time and need, radon measurements will be performed in and around the mine site. The objective will be to collect sufficient radon information to ensure no noteworthy increase in radon gas occurs downwind from the site and to monitor for any cumulative impacts which might occur as a result of increased mining activities.

Passive dust monitoring will continue and will be used to monitor for significant changes in airborne radioactivity.

Soil samples will be obtained only as needed to delineate possible radionuclide increases from accidental releases or to ensure that ground water, if present, will not be adversely impacted.

Water sampling will continue at any operating on-site wells. The collection program will be integrated with the water sampling programs currently in progress at the other mining operations on the Arizona Strip. It is hoped that the water results and associated information may be used by the Bureau of Land Management, Forest Service and Park Service to assist with ongoing, long- term assessments of water quality in the Grand Canyon area.

Whenever a haulage accident occurs a radiological report will be prepared. The report will contain such information as the amount of material spilled, the extent of area affected, measures taken to provide an adequate cleanup, results of the

final radiological survey, and estimates of any possible non-occupational exposures.

B. Alternatives Considered

1. Alternative 1

No Action. The No Action alternative is a continuation of existing conditions. The details of this are described in the section on "Affected Environment." Under the no action alternative, the Plan of Operations would be denied if it did not meet the criteria of 43 CFR 3809 surface protection regulations to prevent unnecessary or undue degradation. The plan would be returned to Energy Fuels to be resubmitted when it had been upgraded to meet the requirements of the law.

2. Alternative 2

This alternative would involve approval of the plan of operations as submitted.

3. Alternative 3

This alternative involves approval of the Plan of Operations with various additional mitigation or stipulations, including but not limited to the following:

- o Alternative access to the project area as depicted on Figures 11 and 12.
- o Use of other forms of transportation for employers to access the mine site, i.e. private cars, aircraft.
- o Relocation of surface facilities within the mine yard.
- o Require reclamation of the two temporary access roads that now lead into the site.
- o Require EFN to fully construct holding ponds before uranium ore is stockpiled on the surface; i.e. beginning of Phase I.
- o Require dust suppressent on the approved access.

IV. THE AFFECTED ENVIRONMENT

As stated previously in Section III.B. the affected environment is equivalent to that situation that exists currently in the District, prior to EFN submitting their mining proposal. This means all existing mining activities and their environmental impacts are included in the current situation. The proposed action and all alternatives will therefore be evaluated against existing conditions.

A. Land Status

Figure 1 shows the existing land status and boundaries of interest in relationship to this project.

Specifically, this project is located within the unsurveyed Township, T38N, R4W, of SW¼ Sec. 17. Both surface and mineral estates are owned by the federal government and are open to mineral entry under the General Mining Laws of the United States.

B. Non-Living Components

1. Climatology/General

The general area is classified as a semi-arid continental climate. It is typified by cool winters, warm summers and light precipitation. Winter temperatures commonly drop below freezing at night while summer temperatures routinely rise above 90°F in the day.

a. Precipitation

Twenty-three years of data have been summarized at the Fredonia, Arizona weather observation station. A summary of this data shows the average precipitation is 10.1 inches (see Figure 5).

In addition the Bureau has summarized at least 13 years of local rain gauge data in the immediate vicinity of the project area. The results of which are shown in Figure 6.

b. Winds

In 1983, a one-year data set was collected from a meteorological station by independent consultants (Fox Consultants, Inc.) to measure wind patterns of the area.

Prevailing wind directions at the project area is from the south-southwest, with south-southeast through southwest winds clearly dominating the wind patterns of the area (approximately 40% of the time). Easterly component winds are least frequently occurring at the project area, with east-southeast winds occurring less than 1.0 percent of the time.

CLIMATOLOGICAL SUMMARY FOR FREDONIA, ARIZONA[1]

	Temperature (°F)					Precipitation (in.)				Mean No. Days Precipitation[2]
		Mean Daily	Mean Daily Extremes			Totals	Snowfall			
Month	Mean Monthly	Maximum	Minimum	High	Low	Mean	Maximum	Mean	Maximum[2]	.1"
JAN	32.7	46.0	19.4	66	-18	1.17	3.28	8.1	13.6	4
FEB	36.2	50.6	21.7	71	-15	.89	1.65	4.2	11.0	3
MAR	42.4	58.6	26.2	79	5	1.09	3.56	4.2	14.5	2
APR	50.7	68.7	32.7	86	10	.68	1.87	.7	2.0	1
MAY	58.0	77.0	39.0	94	20	.44	1.33	0	0	2
JUN	66.5	86.7	46.2	104	26	.32	.96	0	0	1
JUL	73.8	92.8	54.7	105	37	.69	1.88	0	0	2
AUG	72.1	90.1	54.1	104	33	1.27	2.68	0	0	4
SEPT	65.1	84.6	45.6	99	26	1.04	2.82	T	T	2
OCT	53.8	72.4	35.4	96	17	.88	3.09	.3	1.5	2
NOV	41.6	58.3	24.9	76	0	.62	1.39	1.2	6.0	3
DEC	34.6	48.5	20.7	70	-15	1.00	2.30	4.6	6.0	2
ANN	52.3	69.5	35.1	105	-18	10.09	3.56	22.3	14.5	28

Source: Climatography of the United States No. 86-2 Arizona.

1. Unless otherwise specified, based upon period of record 1937 - 1960.
2. Period of record 1951 - 1960.

FIGURE 5

SUNSET

YEAR	FALL	WINTER	SPRING	SUMMER	ANN. TOTA	FALL AVE.	WIN. AVE.	SPR. AVE.	SUM. AVE	ANN. AVE.
71-72	1.24	.98	.56	2.66	5.44	1.76	2.14	2.29	3.61	9.80
72-73	3.41	2.39	3.19	1.46	10.45	1.76	2.14	2.29	3.61	9.80
73-74	.23	1.06	.06	1.38	2.73	1.76	2.14	2.29	3.61	9.80
74-75	1.79	2.11	3.89	2.86	10.65	1.76	2.14	2.29	3.61	9.80
75-76	.32	1.60	1.86	5.88	9.66	1.76	2.14	2.29	3.61	9.80
76-77	.13	.40	1.11	1.48	3.12	1.76	2.14	2.29	3.61	9.80
77-78	.80	4.41	3.75	2.01	10.97	1.76	2.14	2.29	3.61	9.80
78-79	3.90	4.36	.89	3.12	12.27	1.76	2.14	2.29	3.61	9.80
79-80	.74	3.69	4.03	3.83	12.29	1.76	2.14	2.29	3.61	9.80
80-81	2.71	1.15	3.58	1.37	8.81	1.76	2.14	2.29	3.61	9.80
81-82	2.29	2.20	2.62	8.07	15.18	1.76	2.14	2.29	3.61	9.80
82-83	2.77	2.23	3.40	7.26	15.66	1.76	2.14	2.29	3.61	9.80
83-84	2.15	1.30	.47	3.25	7.17	1.76	2.14	2.29	3.61	9.80
84-85	.72	3.76	2.31	2.75	9.54	1.76	2.14	2.29	3.61	9.80
85-86	3.18	.42	2.58	6.84	13.02	1.76	2.14	2.29	3.61	9.80

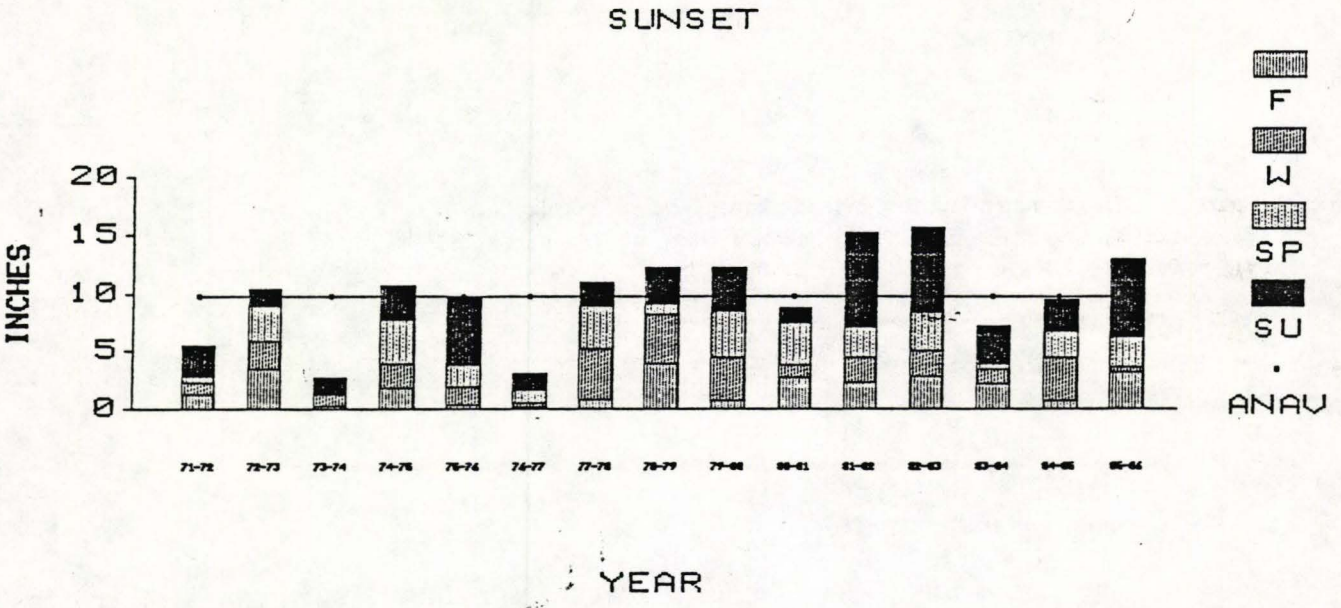


FIGURE 6

Wind speeds averaged 3.4 m/sec (7.6 mph) throughout the one-year monitoring period, with the higher average wind speeds more often associated with the southerly component winds. Higher wind speeds were not as common as wind speeds in excess of 11 m/sec (24.6 mph) occurred only 0.32 percent of the time. (Appendix, Air Quality Impact Analysis of the Hermit Project, Enecotech, 1987).

2. Air Quality

The airshed in this vicinity is designated Class II airshed. Virtually no industrial pollutants exist. Air quality and visibility are good to excellent. The major pollutant is fugitive dust resultant from disturbed areas, roads, stockponds and high livestock use areas.

A Meteorological Monitoring Program was conducted on the Arizona Strip at Sunshine Point to establish the natural background levels of Total Suspended Particulate, (TSP).

All the data collected was in accordance with EPA monitoring and Quality Assurance (QA) guidelines. As part of the QA guidelines the monitoring study program colated samples to assess the precision of the TSP measurements.

This data showed the annual geometric mean to be 13.7 mg/m^3. The highest 24 hour concentration measured in the sampling period was 59 mg/m^3.

Because of the close proximity of the monitoring station to the Project Area, the similarities in climatology and absence of nearby major industrial sources, this data is a good representation of the baseline conditions at the project area.

For brevity, the entire Air Quality Impact Analysis for the Hermit Project is located in the Appendix.

3. Water Resources

Surface water in this area is derived exclusively from precipitation. Storm intensity can be quite severe due to small intense localized summer showers. Surface waters exist in the form of impoundments constructed and designed to capture the intermittent flows from localized and sporadic showers for livestock use. There are two such structures, each approximately 1.0 miles north and south of the project area. A third water source is located at the project site and was minor perched alluvial aquifer that is ephemeral in nature. It is controlled by EFN.

Ground Water

Throughout much of the Colorado Plateau, the regional ground water table is deep and controlled largely by the elevation of the Colorado River and its major tributaries which are deeply incised. In the viscinity of the Hermit Mine, the regional water table is at a depth greater than 2,000 feet and approximately 1,000 feet below the proposed depth of mining.

Perched ground water conditions occur locally within the sedimentary sequence above the regional water table. Perched (alluvial) aquifers, however, are typically discontinous and frequently not capable of being produced on a sustained yield basis due to low rates of natural ground-water recharge and their limited lateral extent.

At the Hermit Mine, perched ground-water conditions have been identified during exploratory drilling within the Coconino sandstone immediately above its contact with the underlying Hermit shale and within the Toroweap limestone. Other perched ground-water zones may also be anticipated to occur at isolated or discontinuous lenses within the Toroweap and Kaibab limestones. These perched zones may yield small quantities of water to mine workings as they are penetrated.

The experience at the Hack Canyon and Pigeon Mines, which are located in the same general area, has been that the rates of ground-water inflow to the mine workings decrease with time and generally cease within a period of several months. Parametric studies have further shown that based on the observed rates of ground water inflow at the Hacks Canyon and Pigeon Mines, the effective radius of influence as a result of drainage into the mine workings will be small and is typically less than a few thousand feet.

The final depth of mining is nearly 1,000 feet above the regional ground-water table within the Redwall-Mauv limestone aquifer. The Red Wall-Mauv aquifer is the upper most aquifer of importance capable of supplying a continuous water supply of a few gallons per minute.

Visual observations within the three Hack Mines and Pigeon Mines have shown the absence of open fractures or joints within the Pipe and that essentially all of the voids within the rubblized collapse zone have been filled with a fine grained matrix comprised of carbonaceous materials. As a result, the breccia pipe and the area immediately surrounding the pipe are effectively impermeable. This has been confirmed by laboratory tests on core samples taken from the same rock formation at the Canyon Mine project. These tests indicate

that the hydrolic conductivities of the rock mass within and adjacent to the pipe is less than 1 X 10^{-8} cm/sec. This is consistent with the observed conditions in operating mines on the North Rim, specifically the Hack Canyon and Pigeon Mines.

In general, the geology in combination with low precipitation and high evaporanspiration losses leads to little water actually infiltrating and percolating downward to the regional water table. Although the exact rates of natural recharge are not known, it is suggested that the rates of natural recharge are probably on the order of several hundredths to a few tenths of an inch per year (Metzer, 1961).

A small potential exists for minor perched ground water conditions to occur above the regional water table wherever a permeability contrast exists, for example, immediately above the contact of the permeable Coconino sandstone with the underlying low permeability Hermit Shale. Perched water may also be anticipated to occur as isolated or discontinuous lenses within the overlying Toroweap and Kaibab limestones. The existance of localized perched ground-water zones above the regional water table is manifested in isolated springs and seeps along the walls of the Grand Canyon and tributary canyons. The discharge from most of these springs is typically less than a few gallons per minute and frequently intermittant.

4. Soils

Soils in this area are alluvial derived from both Kaibab limestone and Moenkopie siltstone. These soils range from cobbly sandy loams to silt loams. Soils vary in depth from shallow on limestone ridges to deep in the Moenkopie swales. All are well drained. Erosion potential is low to moderate due to low relief.

Productivity of these soils are generally moderate, presently supporting mostly grassland/half shrub communities.

Given the subtle topography, low slope factor, there appears to be little potential for significant off site soil loss. For more information see The Soil Conservation Services Order III soil survey completed in 1984.

5. Regional Geology

The Kaibab Plateau, on which the Hermit Mine prospect is located, is underlain by a thick sequence of horizontal to gently dipping Paleozoic rocks (570 to 225 million years before present). The sedimentary sequence, which is exposed in the walls of the Grand Canyon, ranges from about 3,500 to

4,500 feet thick and overlies highly-deformed Precambrian (older than 570 million years before present) sedimentary, metamorphic, and igneous rocks. The Precambrian rocks form the basement complex which for practical purposes constitute the lower limit of ground-water occurrence and movement (National Park Service, 1984). While some ground water undoubtedly occurs within the Precambrian, the quantities and its significance are small compared to those within the overlying sedimentary strata.

Stratigraphy

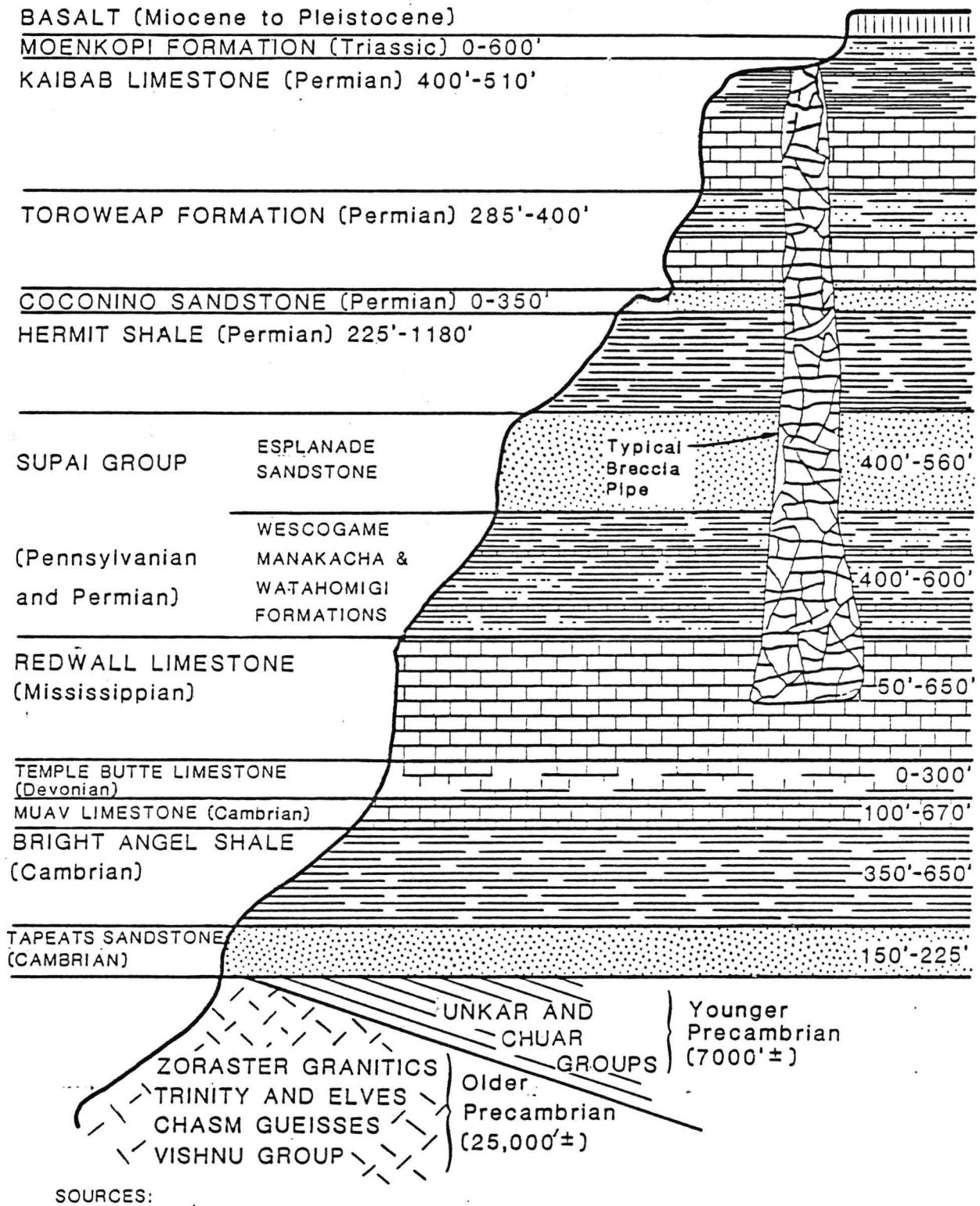
The generalized stratigraphy in the Hermit Mine site area is shown on Figure 7 and discussed below.

In the Hermit Mine site area, the uppermost formation is the Moenkopi of Traissic age. The Moenkopi consists of red siltstone and claystone which outcrop directly at the surface or underlie the surface at a shallow depth. The formation in the mine site area ranges from about 100 to 500 feet in thickness.

The Moenkopi is underlain by the Kaibab and Toroweap limestones. These formations dip gently to the north and are exposed in the walls of the Grand Canyon. In the Hermit Mine area, the aggregate thickness of the Kaibab and Toroweap Formations is 600 to 800 feet. In the vicinity of the Hack canyon and Pigeon Mines, the Toroweap Formation consists of a basal unit of sandstone and shale approximately 30 feet thick (Seligman Member), a 210-foot thick middle unit of fossiliferous grey limestone (Brady Canyon Member), and an upper, slope-forming unit of about 160 feet of gypsiferous shale and siltstone (Woods Ranch Member).

The Kaibab Formation consists of a lower member of fossiliferous, cherty, limestone (Fossil Mountain Member) and an overlying sequence of thinly-bedded limestone, shale and gypsiferous siltstone (Harrisburg Gypsiferous Member).

The Coconino sandstone directly underlies the Toroweap limestone at a depth of 900 to 1,000 feet within the mine area. The Coconino ranges in thickness in the mine area from about 30 to 50 feet. In the canyon rim north of the visitor center at the Grand canyon national Park, the Coconino sandstone is approximately 300 feet thick. The Coconino sandstone is a white, cross-bedded eolian deposit of Permian age.



SOURCES:

- DEPT. OF INTERIOR, 1976, DRAFT ENVIRONMENTAL STATEMENT, GRAND CANYON
- NUEXCO, REPORT 176, APRIL, 1983

Arizona Strip District
Generalized Stratigraphy

Dames & Moore

FIGURE 7

The Coconino sandstone is underlain within the mine area at depths of 930 to 1,050 feet by the Hermit shale. The Hermit shale is a dense, clay-cememted siltstone and behaves as a confining bed under the coarser and more permeable Coconino sandstone. As a result of the permeability contrast between these units, perched ground-water conditions may exist locally above the contact. Also springs and seeps may occur locally along the contact between those units in the canyon walls.

The Hermit shale, in turn, is underlain by the Supai Formation which extends from about 1,050 to 2,300 feet below the surface. The upper few hundred feet of the Supai Formation is the resistant sandstone that resulted in the formation of the inner gorge of the Grand Canyon. The upper Supai Formation and the overlying Hermit shale are the main host rocks for the ore deposit at the Hermit prospect. The lower portion of the Supai grades from a sandstone to a limestone which overlie the older limestones of the Redwall Formation.

The Redwall and underlying Temple Butte and Muav limestones collectively comprise the Redwall-Mauv aquifer of Northern Arizona. The Redwall limestone is a thickly-bedded, fine-grained limestone that typically is a cliff former where exposed along the walls of the Grand Canyon. In the area of interest, the Redwall is approximately 450 feet thick. The upper karstic member of the Redwall limestone is the source of the existing water supply for on-going operations at the Pigeon Mine, Kanab North, Pinenut, and the Canyon Mines. It is also the proposed source of water for the Hermit Mine.

The Temple Butte limestone, which underlies the Redwall, consists of interbedded dolomite, dolomitic sandstone, sandy limestone, siltstone and sandstone. It crops out as thin ledges and occupies small channels cut into the underlying Muav limestone. The Muav limestone consists chiefly of dolomitic limestone and is gradational with the underlying Bright Angel shale.

Structural Geology

Major north-south trending faults provide geologic and topographic boundaries to many of the plateaus. The Kanab Plateau on which the Hermit Mine is located, lies between the Toroweap-Sevier Fault on the west and the West kaibab Fault on the east (Figure 8). Both of these faults trend north-northeast with movement on the order of hundreds of feet. The West Kaibab Fault and the East Kaibab Monocline form the boundaries of the Kaibab upwarp (Kaibab Plateau), topographically the highest of the area. The East Kaibab Monocline and the Vermillion Cliffs intervene between the Kaibab Plateau and the Paria Plateau to the northeast. The Kanab Valley Fault bisects the Kanab Plateau.

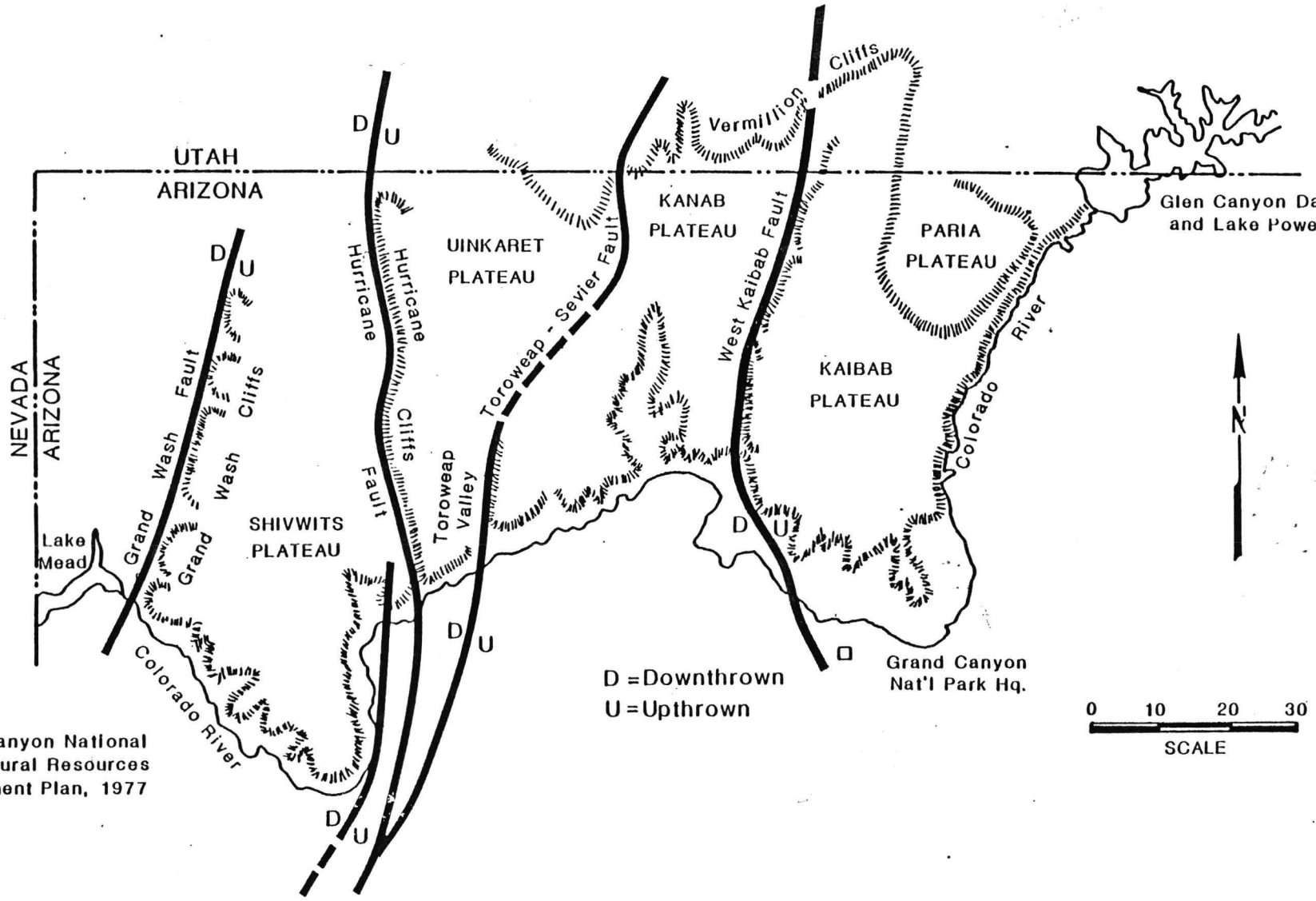
Movements along many of the faults began in the Miocene, but much of the activity peaked during Pliocene time. The faults are thought to be related to underlying Precambrian zones weakness. Numerous smaller faults and folds are also present; these generally trend north, northwest, or northeast.

Breccia Pipes

Roughly cylindrical, pipe-like collapse structures, termed breccia pipes, are common geologic features across the southern portion of the Colorado Plateau. The breccia pipes are relatively small in diameter, generally less than 500 feet, but may be thousands of feet deep. The pipes contain broken, rubbled rock from surrounding formations encircled by a series of concentric ring fractures. The more-permeable annular fault ring and the rock debris within the center of the pipe provided a vertical conduit for ascending and/or descending mineralizing fluids. When mineable ore occurs in a pipe, it typically is located in both the annular fault ring and the central breccia matrix, principally in the Hermit and Supai Formations. Because the pipes are not known to extend below the Redwall limestone, it is generally held that the pipes resulted from successive chimney collapse of the overlying formations into solution caverns developed within the Redwall limestone:

> "Geologists believe that cavities formed millions of years ago by dissolution of portions of the Redwall limestone (which) created space into which the overlying rock collapsed. The collapse zone propagated its way up hundreds, and in some instances, several thousands of feet in the form of a narrow cylinder or cone. This broken rock or pipe created a favorable environment for mineral deposition" (U.S. Forest Service, 1985).

Subsequent to the formation of the breccia pipes and mineralization, the materials within the pipe and in surrounding areas have been recemented and the void spaces filled with a fine-grained matrix consisting mainly of carbonaceous materials. As a result, the breccia pipe and the area around the pipe is effectively impermeable. Laboratory tests, for example, on rock core from the breccia pipe and surrounding areas at the Canyon Mine, (located south of the Grand Canyon), have shown the rock-mass hydraulic conductivities generally to be less than 1×10^{-9} cm/sec.



Source:
Grand Canyon National Park Natural Resources Management Plan, 1977

Arizona Strip District

Major Structural and Physiographic Features Map

Dames & Moore

FIGURE 8

6. Radiological Assessment

The natural radiation environment consists of cosmic radiation and many radioactive elements including Hydrogen - 3, Carbon - 14, Potassium - 40, Rubidium - 87, Uranium -235, Uranium - 238 and Thorium -232. Importantly both Uranium -238 and Thorium -232 are ubiquitious in soil with average concentrations of a few parts per million. Each are parent elements of a radioactive decay series. The thorium decay series is not significant in the Hermit ore body or other uranium deposits in Arizona so it will not be discussed here.

Natural uranium is about 99.3% U-238 so the radiation contribution from the U-235 series is insignificant.

Radioactive materials are naturally present in air, water and soils. Typical concentrations of naturally occuring uranium and Radium-226 in normal soil are on the order of 1 pico-Curie per gram. A pico-Curie (pCi) is equivalent to 2.22 atoms of the radionucliide decaying each minute (an extremely small number). Typical concentrations of Uranium and Ra-226 in surface, ground and domestic water are on the order of 1,3,2 pCi/L. Arizona's uranium concentrations in water have been reported to be between 2.5 and 2.7 pCi/L. These values vary considerably depending on the extent of uranium mineralization in the area.

The units of dose are rem (roentgen equivalent man). Because this unit is so large, it is useful to divide the value by one thousand and discuss radiation dose in terms of 1/1000 rem, or millirem (mrem). Dose rates are described as mrem per hour or per year.

Some typical radiation doses are as follows:

Source	Dose, millirem
Maximum allowable average occupational dose	5,000/yr.
Average dose received by all workers, uranium mines	365/yr.
Average allowable dose to general public	170/yr.
Canyon Mine Project	70-125/yr.
Hermit Project	105/yr.

Hacks Canyon and Kanab North	70/yr.
Average dose from diagnostic X-rays	70/yr.
U.S. average in water and food	25/yr.

Normal environmental outdoor concentrations of radon are generally less than 1 pCi/L. However, in uranium mines, radon concentrations may increase measurably.

Background Radiation

Four monitoring stations which measure background gamma radiation were established around the Hermit Project in September of 1986. The sites are approximately ¼ mile north, south, east and west of the proposed mine.

Other monitoring stations are in place at the Pinenut, Kanab North and Pigeon Mines and an extensive monitoring network has been set up at the Canyon Mine. Since gamma radiation data for all mine sites is being collected using identical detection methods and the entire region has similar radiation characteristics, any changes from existing background will be obvious.

Initial onsite measurements made in September 1986 and January 1987 indicate that the background gamma radiation exposure rates are on the order of 105 mrem/yr.

The entire Radiological Assessment of the Hermit Project is located in the Appendix of this document.

7. Accoustics

Due to the complex nature of accoustical studies conducted previously to evaluate potential impacts, an accoustical guide in the Appendix has been added describing nomenclature, instramentation and methodologies used to gather and analyze data.

Background ambient sound levels within the accoustical environment of the Arizona Strip District vary depending on the proximity of receptors to human activities; particularly highways or local roads, aircraft flight paths and local meteorological conditions. The most common noises resulting from man's activities in the Arizona Strip include off road vehicles such as jeeps, motorcycles and trucks (including lumber, oil and ore trucks) on U.S. Alternate 89, State routes

67 and 389 and other unpaved roads such as Ryan or Mt. Trumbull roads.

The Day-Night Average Sound Levels (Ldn), for open unpopulated areas away from highways is expected to vary from 30-45 dB (decibels). (U.S. Bureau of Reclamation, 1976; National Park Service, 1976) (16). For most detailed information on Acoustics in the Area refer to the Final Pinenut Environmental Assessment.

C. Living Components

1. Wildlife

A diversity of wildlife species has the potential to exist within the general project area.

a. Big Game

Extensive ground and limited aerial surveys were contracted by EFN for this proposed action. These surveys were designed to provide site-specific baseline data and to determine the extent and intensity of wildlife utilization (Spectrum Sciences and Software; Sigler and Associates; 1987). This contracted studies generally supports the data and observations of the Arizona Game & Fish and BLM as described in the Clayhole Habitat Management Plan (HMP).

Mule deer use and occurrence is nominal given the lack of cover around the actual mine site and access roads. Densities of mule deer are estimated to be below 0.5 deer per square mile. However, adverse winter cause deer herds to move from the Kaibab onto winter range areas along the tributaries of Kanab Creek.

Three miles south of this project, the terrain is more variable with substantial amounts of more diverse vegetative cover. Mule deer densities are greater with the better habitat conditions. However, survey data reflects very low numbers. Lack of desirable habitat components (esp. water) in the area precludes any liklihood for large numbers of mule deer.

About 300 pronghorn antelope occur in the Clayhole/ Antelope Valley area. The established herds have not pioneered into this area although it is considered

suitable habitat. However, a few isolated sightings are known in the Sunshine Point area.

About twenty-five desert bighorn sheep are now inhabiting portions of lower Kanab Creek from Grama Canyon south. The sheep are located several miles from the proposed action. Plans exist to manage for sheep throughout Kanab Creek in suitable habitat.

b. **Birds of Prey**

No birds of prey inhabit the local or immediate area due to lack of suitable nesting areas. The closest such habitat is approximately 6.0 miles to the east (Kanab Creek Canyon) or 3.5-4.0 miles south in the lower reaches of Gramma Canyon.

The project area supports a prey base utilized by more common raptor species such as red tail hawk.

c. **Non-Game/Small Game/Passerines**

The immediate habitat, is home to a variety of non-game/small game species.

An indepth species list follows, and cites relative abundance and habitat preferences of each species that has a potential to occur in this area.

o Indicates that the species has a "potential" to occur in the habitat type.

Species	Abundance*	Grassland	Desert Shrub
Great Basin Spadefoot Toad	C	o	o
Red Spotted Toad	C		o
Desert Night Lizard	C		o
Lesser Earless Lizard	N		o
Zebra-tailed Lizard	C		o

Species	Abundance*	Grassland	Desert Shrub
Leopard Lizard	C	o	o
Collard Lizard	C	o	o
Desert Spring Lizard	LC		o
Western Fence Lizard	U		o
Eastern Fence Lizard	C	o	o
Sagebrush Lizard	A	o	o
Side blotched Lizard	A	o	o
Desert Horned Lizard	C	o	o
Plateau Whiptail	C	o	
Tiger Whiptail	C	o	o
Western Blind Snake	U		o
Coachwhip	C		o
Striped Whip Snake	C	o	
Gopher Snake	A	o	o
Glossy Snake	C		o
Common King Snake	C	o	o
Longnose Snake	C		o

*Abundance: A = abundant, C = common, U = uncommon, R = rare
L = Local, S = Spotty, I = isolated, N = no record but may occur.

Species	Abundance*	Grassland	Desert Shrub
Sonora Lyre Snake	R	o	o
Desert Night Snake	C	o	o
Back-tail Rattle Snake	LV		o
Great Basin Rattle Snake	A	o	o
Mojave Rattle Snake	C		o
Desert Sidewinder	C		o

Source: Reptiles and Amphibians of the Arizona Strip
(1978, U.S.G.P.O. - 786-167)

Species	Abundance*	Grassland	Desert Shrub
Desert Shrew	SR	o	
California Myotis	C		o
Yuma Myotis	U	o	o
Western Ripstrelle	A		o
Mexican Big-eared Bat	R	o	o
Silver-harred Bat	R		o
Hoary Bat	U		o
Spotted Bat	LR		o
Brazilian/American Free-tailed Bat	C	o	o
Desert Cottontail	C	o	o

Species	Abundance*	Grassland	Desert Shrub
Jack Rabbit	A	o	o
Cliff Chipmunk	C	o	o
Antelope Ground Squirrel	A	o	o
Roundtailed Ground Squirrel	N		o
Common Pocket Gopher	C	o	
Little Pocket Mouse	C		o
Great Basin Pocket Mouse	C	o	o
Longtail Pocket Mouse	C		o
Desert Pocket Mouse	C		o
Ord's Kangaroo Rat	A	o	
Chisel-toothed Kangaroo Rat	C	o	o
Merriam's Kangaroo Rat	C	o	
Canyon Mouse	C		o
Deer Mouse	A	o	
Brush Mouse	C	o	o
Short-tailed Grasshopper Mouse	U	o	
Desert Woodrat	A	o	o
Coyote	A	o	o
Kit Fox	U		o
Grey Fox	C	o	
Badger	C	o	o
Spotted Skunk	U	o	o
Mt. Lion	U	o	o
Bob Cat	U	o	o
Muledeer	C		o
Pronghorn	LS	o	
Bighorn	LR		o

Source: Mammals of the Arizona Strip
(U.S.G.P.O., 1978 - 786-167)

Species	Abundance*	Grassland	Desert Shrub
Turkey Vulture	C	o	o
Gosnawk	R	o	o
Marsh Hawk	C	o	o
Rough-legged Hawk	C	o	o
Ferruginous Hawk	R	o	o
Red-tail Hawk	C	o	o
Golden Eagle	C	o	o
Prairie Falcon	U	o	o
Peregrine Falcon	R/ Endangered	o	o
Kestrel	C	o	o
Roadrunner	C	o	o
Great Horned Owl	A	o	o
Common Nighthawk	C	o	o

Species	Abundance*	Grassland	Desert Shrub
Lesser Nighthawk	C	o	o
Broad-tailed Hummingbird	U	o	o
Calliope Hummingbird	U	o	o
Anna's Hummingbird	R	o	o
Black-chinned Hummingbird	C	o	o
Costa's Hummingbird	U	o	o
Rufous Hummingbird	U	o	o
Cassin's Kingbird	C	o	o
Wied's Crested Flycatcher	R	o	o
Ash-throated Flycatcher	C	o	o
Olivaceous Flycatcher	R	o	o
Black Phoebe	U	o	o
Horned Lark	A	o	o
Common Raven	C	o	o
Bewick's Wren	C	o	o
Cactus Wren	C		o
Rock Wren	C		o
Canyon Wren	C		o
Mockingbird	C	o	o
Sage Thrasher	R		o
Bendire's Thrasher	U	o	o
Le Conte's Thrasher	U		o
Townsend's Solitaire	U		o
Blue-gray Gnatcatcher	C		o
Black-tailed Gnatcatcher	U		o
Phainopepla	U		o
Northern Shrike	R		o
Loggerhead Shrike	C	o	o
Bell's Vireo	R		o
Orange-crowned Warbler	R		o
Lucy's Warbler	C		o
Yellow Warbler	A		o
Yellowthroat	R		o
Macgillivray's Warbler	U	o	
Wilson's Warbler	R		o
House or English Sparrow	U	o	
Western Meadowlark	C	o	o
Brewer's Blackbird	C	o	o
Brown-headed Cowbird	C	o	o
Scott's Oriole	U	o	o
Western Tanager	C		o
Summer Tanager	R		o
Pyrrhuloxia	R		o
Brown Towhee	R		o
Albert's Towhee	R		o
Savannah Sparrow	U	o	o
Lark Bunting	R		o

Species	Abundance*	Grassland	Desert Shrub
Vesper Sparrow	U	o	o
Lark Sparrow	C	o	o
Black-throated Sparrow	A	o	o
Sage Sparrow	U	o	o
Rufous-crowned Sparrow	U		o
Chipping Sparrow	C	o	o
Brewer's Sparrow	C	o	o
Black-chinned Sparrow	R		o
White-crowned Sparrow	C	o	o
Golden-crowned Sparrow	R	o	o
White-throated Sparrow	R	o	o
Fox Sparrow	U	o	o
Song Sparrow	U	o	o

2. Vegetation

The general area of the mine site as well as the proposed access is located within grassland/desert half shrub type. The area supports 1 AUM per 11.7 acres and is considered in fair to good conditions.

The vegetation composition is basically as follows:

Winterfat	Russian Thistle
Blue gramma	Eriogonum (annuals)
Dropseed	Wolf berry
Big Galleta	Rabbit brush
Indian Rice Grass	Sage
Needle grass	Three-awn
Fourwing	

3. Threatened or Endangered Species

The areas of direct impact were inventoried for all Threatened and Endangered and Category 1 and 2 plant species. None were found.

Specifically, the Hermit Mine site and access was cleared for Pediocactus peeblesianus var. ficheisenii a category 1 species that occurs near the area. None were found. The soil and habitat of the area are not typical for this species. Transects through the area revealed no T&E species nor any other category 1 & 2 species.

Additionally, the area was reviewed for all Threatened and Endangered animal species and none would be directly impacted by this proposed action.

D. Human Values

1. Cultural Resources

A Class III Cultural Resource Inventory was conducted by Abajo Archaeology, at at the location of the proposed mine site and associated ore haulage road. A total of 40 acres encompassing the proposed mine area and 15 acres constituting 1.25 miles of haul road corridor was intensively surveyed.

A total of 5 isolated artifacts were found. No sites, structures or diagnostic features are present. Isolated artifacts include one Elko corner-notched projectile point basal fragment, and the remaining artifacts are non-diagnostic lithic debitage flakes and one core. No paleontological resources are known to occur in the area.

2. Socio-Economics

There are no new published census data since 1980, available for this socio-economic analysis. However, it was assumed that the previous summaries (1970-1980) are still reasonably accurate.

Four counties would be affected by uranium exploration and development at the Hermit Site: Mohave and Coconino Counties, Arizona, Kane and San Juan County, Utah.

a. Population

The Bureau of Census subcounty population data are from units known as census county divisions (CCDs). The primary population areas consist off three CCDs, for which population data are summarized below in Figure 9.

It is reasonable to assume that at least the CCDs containing Kanab, Utah and Fredonia, Arizona have experienced a moderate increase in population, in the period from 1981-1985.

As of 1980, the three CCDs had two incorporated towns, Kanab, Utah and Fredonia, Arizona. Kanab had a 1980 population of 2,148 and Fredonia had a 1980 population of 1,040. The total population in these two towns represent 50.4 percent of the 1980 populations for the three CCD north of the Grand Canyon National Park. The eastern portion of the Mohave North CCD contains most of the Kaibab Indian Reservation population as well as the small communities of Moccasin and Colorado City. These three population units represent an estimated 25 percent of the total population of the three CCDs north Grand Canyon National Park.

FIGURE 9

Census County Division Population Change: 1970-1980

CCD	Population 1970	1980	1987	Numerical Change	Percent Change
Mohave North (Co.)	950	1,786		836	88.0
Kaibab (Coconino Co.)	967	1,417		950	46.5
Kanab (Kane Co.)	1,621	3,116*(4800)		2,781	92.2
Total:	3,538	6,319	4,067		78.6

Source: 1970 Census; 1980 Census of Population and Housing Arizona and Utah
***Source:** Kane County Job Service 1987 estimate.

FIGURE 10

Selected Employment Data by County: 1980

Employment Category	Mohave*	Coconino**	Kane***
Manufacturing	1,925	2,150	65
Construction	225	50	15
Transportation/Public Utilities	875	1,025	15
Wholesale/Retail Trade	4,575	7,425	275
Finance/Insurance/Real Estate	675	750	40
Services	2,750	7,675	145
Government	2,625	8,925	275
Agricultural	4,075	1,100	435
Other	-	-	-
Total	18,625	31,275	1,370

*Arizona Statistical Review, Valley National Bank, Phoenix, Arizona 1982.
**Utah, County Economic Facts, 1980, Utah Industrial Development Information System, Salt Lake City, Utah.

As of July 1984, the following unemployment rates existed for the three counties:

	1984	1987 1st Quarter ****
*Mohave *(AZ)	7.3% unemployment	Feb. 10.9%
**Coconino (AZ)	9.0% unemployment	Feb. 10.9%
***Kane (UT).	10.0% unemployment	Feb. 7.2%

*Source: Mohave/Coconino County Job Services (Telephone Conversation)
***Source: Kane County Job Services (Telephone Conversation)
****Source: Arizona Department of Economic Security (Telephone Conversation)

(Both sources were named from quarterly unemployment bulletins.)

b. Employment

Figure 10 shows employment data for Mohave, Coconino and Kane Counties.

In addition to the above data, it is known that operations at the three Hack Canyon Mines (from 1980-1984) has generated at least $2,456,000 of severance, and property taxes for the state of Arizona. This figure will be actually higher when the other mines (Kanab North, Pigeon and Pinenut) are brought into production. EFNs presence in the communities of Kanab and Fredonia provides significant employment and benefits accrued therein.

3. Public Attitudes

Attitudes of the public regarding mineral exploration can be classified as falling into one of three categories: uninterested/uninformed, supportive, and opposed.

a. The Uninterested/Uninformed Category

According to the 1980 Census data, 134,664 people live in the three county region. Figure 9 shows 6,319 residents in the three CCDs closest to the Pinenut Site, representing only 4.7 percent of the total population (three counties). Most residents live in larger cities of Coconino and Mohave Counties, such as Flagstaff, Kingman, Lake Havasu City, Bullhead City, Riviera and Page. Because of uneven population distribution, one can assume that a large portion of its residents are not aware of, informed or interested in uranium exploration at Hermit.

b. The Supportive Category

Support for the proposed action exists on two levels. Generally, most of the three county residents are traditionally supportive of mining. Many feel that mining has been an important part of the economy and mining benefits the economy. Such supporters are sympathetic to the concerns of mining companies and are concerned about Federal and State Legislation/Regulation, which they view as curtailing/hampering mineral development and production.

On a more specific and localized level, past and present experience demonstrates, residents of the CCDs strongly support the proposed action. They perceive the proposed action as a source of potential employment and economic benefit. To many, this action represents the kind of development needed to broaden the economic base of the area beyond ranching, tourism and retirement.

c. The Opposition Category

Two specific groups oppose the proposed action. The main opposition comes from one local group and various individuals associated with specific environmental interests and issues. The second group of opponents consists of outside regional environmental groups. Some of these individuals who are aware of specific mining activities in the area oppose more mining. Others, unfamiliar with the specifics of the proposed action, apprehensive over the preceived potential health hazards of uranium mining and processing (in general the nuclear fuel cycle).

4. Wilderness

This area is approximately 7 miles west of the designated Kanab Creek Wilderness Area (Figure 1).

5. Visual Resources

The proposed project area is located on the Kanab Plateau. Relief is very gently undulating with an elevational difference of approximately 60-80 feet per square mile.

The proposed project area occurs on a portion of one of the important viewsheds on the district i.e. visable from Highway 389 and portions of the Kaibab National Forest. This is a designated Class IV visual designation in which most contrasts attracts attention and will generally dominant the landscape.

More importantly, the area is the foreground view and provides visitors with the open space/remote perceptions that are so important to recreationists seeking open spaces or exceptional sightseeing opportunities.

The Mt. Trumbull Road is the most important Travel Corridor (Travel Influence Zone) within the Resource Area, excluding the state highway system. This is evident by the large number of visitors (6,000 - 7,000) received at the Toroweap Overlook within the Grand Canyon National Park.

6. Other Values

The main value of this area as stated in the Management Framework Plan is the support of ranching, wildlife hunting and mineral interests as well as providing for open space and remote character.

Sightseeing is a common use of this area along the Travel Influence Zone, but camping or other forms of recreation are not known to occur in the area of the new proposed mine.

E. Cumulative Impacts

1. Existing Situation

Uranium exploration and development has been ongoing within the Arizona Strip District since approximately 1980. At present, the number of companies operating within the District has decreased by 50% since 1980.

Those companies still active in uranium operation are as follows:

Company	Comment
Energy Fuels	Presently the only company active in production, with 1 producing mine, 3 mines being reclaimed and two mines gearing up for production
Pathfinder Mines	Active in exploration only, with generally 2 drill rigs active full time. Exploration basically limited to specific claim blocks.
Rocky Mountain	Active in exploration only, with 1 drill rig full time on BLM lands and 1 drill rig full time on state and private lands (mostly in the Shivwits Resource Area).
Uranerz	Active in exploration within Shivwits Resource Area. Activities limited to Savanic, Cunningham and Copper Mountain Mines and a few isolated claim blocks throughout the district.

Cumulative Surface Disturbance Impacts Resulting from Exploration

As of the last Environmental Analysis for a uranium mine (Jan. 1986; Pinenut Environmental Assessment), it was determined that the following amounts of disturbance resulted from exploration in an approximate six year period.

Total Surface Disturbance	Total Reclamation	Total Unreclaimed (Pine Nut EA)
519 acres	447 acres	72 acres -60 acres since reclaimed 12.0

Since that period the following additional activities and disturbance has occurred:

Company	Plans	Notices	Amend	Surface Disturbance	Total Unreclaimed Dist.	Comments
EFN	2	24	10	53.0	20	2 mine plans - Hermit and Pinenut, 10 re-entries
PMI	0	9	24	40.6 ac.	13.1 ac.	27.5 ac. to be submitted
RME	0	14	0	28 ac.	0 ac.	6 of 14 notices were re-entries
U	0	4	0	8.0 ac.	0	reclamation yet to be submitted
TOTAL	2	51	34	129.6	33.1	86.5 acres have been reclaimed

*EFN Figures based on 2.0 acres per Notice and 0.5 acres per amendment. Amendments are re-entries to areas previously disturbed. EFN figures also include state lands. Due to use of common access, figures are unrealistically high.

**PMI Figures based on 0.1 acres per pad area (4000 ft.^{2}) plus actual access disturbance (10 ft. wide) and actual trenching disturbance. PMI currently maintains a significant amount of "common" access that will be reclaimed.

***RME Figures based on 2.0 acres per notice. RME is currently re-contracting reclamation work on all of 1986 notice submissions.

**** Uranerz has reclaimed all notices but plan to re-enter the site.

Reclamation work proceeds immediately after operations cease. However, many drill areas utilize a common access that has been constructed by the companies. Therefore, as the drill site areas are reclaimed the access is left open to continue adjacent exploration.

All companies no longer solvent or active within the District have reclaimed their sites and they have been released by BLM.

One company, Intermountain Exploration still maintains valid claims within the Paria Canyon-Vermilion Cliffs Wilderness Area. Prior to any further surface disturbing activities on these claims a validity exam will be performed to assure complianced with the Wilderness Act.

It is apparent from the above table, that within the last 7 years, exploration activities has resulted in approximately 648.6 acres of disturbance. However of this disturbance, approximately 533.5 acres have been reclaimed.

Even if reclamation were not a requirement, the total percent of surface disturbances compared to that in the resource area or the area of high mineral activities would be very small, generally far less than one tenth of a percent.

Cummulative Surface Disturbance Resulting From Uranium Production

Since 1980, the following cumulative surface impacts from mining have resulted.

Hack's 1, 2	Hack's 3	
9.1 acres disturbance	2.55 acres disturbance	=
4.5 miles existing access upgraded	.77 miles additional access	=

Total 11.66 ac + 10 acres buffer zone = 22.0 acres
Total 5.27 miles of access.

- original access was existing but upgraded to accomodate ore haulage
- 48 people are employed.
- EFN busses employees.
- All three mines are in the first phases of reclamation.
- Mt. Trumbull road is maintained by EFN and the county.
- 14.5 miles of powerline on public lands. This powerline will remain because of the Hermit and Pinenut Mine use.

Pigeon

- 40 acres (including 10 acre buffer zone).
- 10 miles of existing access upgraded to accomodate ore haulage plus 1/4 mile new access.
- 38 people are employed.
- EFN busses employees.
- Hauling is approximately 10-15 trips per day on Ryan road.
- Life expectancy is approximately 1990-1991, reclamation is scheduled immediately afterwards.
- 8.0 miles of powerline .

Kanab North

- 28.0 (includes 10 acre buffer zone)
- 6.5 miles of existing access upgraded to accomodate ore haulage,2.0 miles of new access constructed.
- 8.0 miles of powerline
- Ore haulage will not take place until 1988.
- 42 people are employed.
- Life expectancy 1992, reclamation is scheduled immediately afterwards..

Pinenut

- 20.8 acres (for the mine yard)
- 17.0 miles of existing access upgraded (approximately (0.5 miles of new access resulting from realignment).
- Ore haulage not anticipated until 1989.
- Life expectancy approximately 9 years.
- Approximately 38 people employed.
- 8.3 miles of proposed powerlines

Total Disturbance Resultant from Production

Mine Yard Acreage	115.0 acres
Existing Access Upgraded	39.0 miles
New Access Constructed	3.5 miles
Miles of Powerline	30.5 (on Public Lands)

The total impact of mining disturbances is less than 0.0027% of the entire Strip District. Of special importance is that the three Hacks Canyon Mines will begin reclaimation activities during the second quarter of 1987. Therefore, by Mid-1987, there will be no further ore hauling on Mt. Trumbull Road until the Kanab North Mine comences ore production by mid 1988. In 1990, the Pigeon Mine will begin reclamation. The Pinenut Mine will haul on Mt. Trumbull road from mid 1989 through 1994. Thus there soon will be a significant net decrease in the amount of ore hauling in the area that will persist for at least 3 to 5 years, given the staggared rate of production (assuming no additional mines).

By the time the Hermit Mine is producing, the Hack Canyon Mines will be fully reclaimed, the Pigeon Mine will also be under reclamation, the Kanab North mine will be gearing down for reclamation and the Pinenut Mine will still have several years of production left.

The Environmental Impact Statement (EIS) on the Canyon Mine proposal was prepared by the U.S. Forest Service and

it states that the proposed mine would not have any environmental impacts on the Arizona Strip since the impacts from that kind of mine was so localized.

1. Analysis of Cumulative Impacts from Exploration

Exploration has resulted in approximately 648 acres of surface disturbance within the Arizona Strip since 1980. Of this, 533.5 acres have been reclaimed. The additional acreages that are at present unreclaimed represent ongoing activities or access that is used in common with several exploration areas.

The following impacts have occurred:

Vegetation

Generally vegetation is trampled by overland type vehicles. Damage is usually not severe where heavy equipment has not been used. Blading will destroy vegetation entirely.

Drill pads are generally not bladed unless on an excessive slope. However revegetation is a requirement on plans, notices, amendments or modifications. It is a renewable resource. The 72 acres yet unreclaimed are considered insignificant. Reclamation is an ongoing activity.

It is a requirement that all areas to be disturbed will be in compliance with the Endangered Species Act. To date all T and E species have been avoided.

Wildlife

Generally, wildlife is affected by the loss of vegetation which provides food, cover and nesting sites. Loss of vegetation is not permanent. Given the total loss plus that which is rehabilitated, impacts are considered insignificant.

The presence of humans/machines and other foreign sites, sounds and smells associated with drilling activities are thought to have had a potentially greater impact on wildlife than the actual temporary loss of vegetation. However the short duration of most exploration operations and the small areas affected do not pose significant impacts. Exploration activities generally are separated by great distances and most last less than 3-4 weeks, depending on drilling results.

Peregrine Falcons are provided strict protection during breeding and fledging periods pursuant to Section 7 (ESA) consultation with U.S. Fish and Wildlife Service. No operations have been approved within 1.0 miles of the Kanab Creek rims in superior habitat from the period from March 1 to August 15th.

Soils

Soils are slightly affected by overland travel and where access or drill pads have been bladed. Significant erosion events are eliminated with proper mitigation and reclamation. Impacts are insignificant.

Fugitive dust resultant from vehicle travel is the largest contributor of dust. Historically there are normally less than four drill rigs operating within the entire district at anyone time. Smaller support vehicles do most of the overland exploration activities (ie, casual use operations). The increase in dust resulting from exploration activities is short lived and local to the immediate area around occasional road blading to the exploration site and therefore is considered insignificant.

Air Quality

Impacts to air quality (Class II) are negligible based on the negligable amount of soils actually disturbed. Fugitive dust resultant from vehicle travel constitutes a line source that could be quantified via computer models but would be insignificant given the amount of vehicle use, temporary duration on each site and the amount of disturbance during operations.

Water Quality

No impacts to surface water have been observed on the Strip District as a result of any mineral action.

Ground water is protected and regulated by Arizona State Law which requires immediate plugging of drill holes in a manner that will preclude cross contamination between aquifers or from the surface.

In any event, the probability of finding mineralization in any single hole is extremely low. (The vast majority of holes are found to be barren).

No quantifiable impacts to the Kanab Creek Drainage has ever been observed. Sixty water/sediment parameters are measured regularly and there has never been a quantifiable change in the results obtained which has been attributed to mining activities.

Remoteness

The remote and isolated nature of the district can be said to have been affected to some degree by the increase in exploration activities over the last 5 years. However, the level of frequency of the activities within the district has not been of a magnitude to alter the fundamentably remote character of the district. In order for this fundamental character to be changed, activities would have to expand tremendously. The affect of exploration activities are considered insignificant for the following reasons:

1. The probability of being in the vicinity of a drill rig during operations is extremely low given the great distances that usually separate these activities and the short duration of time (less than 3-4 weeks) that exploration activities persist on any single site.

2. There are less than 4 drill operations occurring simultaneously on the Arizona Strip's 8.5 million acre. Visual impacts are usually screened by topography and vegetation.

3. No permanent adverse impacts are allowed from any operation pursuant to requirements that provide for mandatory reclamation.

Social/Economic Structure

Economic impacts from exploration activities are positive from the standpoint of employment of locals and support needs for exploration and mining equipment. These operations provide economic revenues to local and state agencies. Additional benefits are added by support of other local services that are not directly associated with exploration activity. Most people hired for exploration and mining are "locals" thus the influx of "outsiders" is very limited. It should be noted however that these activities can have negative impacts on those members of the public, that oppose this type of operation.

b. Analysis of Impact from Production

Impacts to soils and vegetation are directly related to the actual surface disturbance that occurs when mine areas, roads or powerlines are constructed. The total amount surface disturbance associated with mining in the District is insignificant when compared to the total amount of land within the District. All operations are temporary and full reclamation is a mandatory requirement.

Visual Impacts

Visual impacts do occur as a result of mining, but such impacts are temporary and usually confined to local on site concerns. Examples: the three Hack Canyon Mine complex can be observed only when one is at the mine site due to twisting canyon turns or at specific places on the rims atop the canyon. The Pigeon Mine is generally not observable from any portion of the access except for the evaporation pond and the yard enclosure atop the canyon. Pigeon Mine is observable from Forest Service lands across the Canyon but not directly visible from the bottom of the Canyon.

The Kanab North Mine is located on the rim of Kanab Creek. It is not visible on the West side of the creek except at an approximate distance of .5 miles when the head frame first becomes visible. Kanab North is visible from a wide area on the east side of Kanab Creek approximately 2.0 miles away, but it is not visible from within the canyon.

Wildlife

Wildlife is potentially affected by ongoing mining operations. Impacts occur due to vehicle use of roads and human activities. The extent of impacts are limited to those impacts that occur within a close proximity to the mine yard or haul route. Impacts are considered insignificant due to the small amount of habitat that is temporarily lost and of short duration of activities and the vast acreages of similar habitat available in the district. Impacts generally are also site specific.

No adverse impacts to resident deer pronghorn or bighorn sheep have been observed as a result of mining activities. There have been no documented cases of mortality to deer, pronghorn or sheep from any hauling operation.

Monitoring for falcons and eagles has occurred. To date there is known evidence that either species has been adversely affected.

Air Quality

Analysis of cumulative impacts on the air quality within the district from mining activities has showed no significant adverse impacts. The small impact areas resulting from mines like the Pigeon Mine and Kanab North Mine and the relatively large distances between operations, make any cumulative impacts highly unlikely. Utilization of haul roads by the operations similarly are not likely to generate levels of TSP which approach the air quality standard of 260 Mg/m. Morever, if such a level were to be approached, mitigation measures are available to reduced the impact. For additional analysis see the proposed action and the Air Quality Impact Analysis for the Hermit Project.

Water Quality

No surface waters have ever been affected as a result of mining operations, including Kanab Creek.

Kanab Creek and several springs are regularly monitored. There has never been an increase above background fluxuation of any mineralized material in the surface water.

V. ANTICIPATED IMPACTS OF THE PROPOSED ACTION

A. Land Status

EFN has not applied for a mineral patient. Therefore, this proposal would have no affect on land status.

B. Non-Living Environment

1. Airshed

A thorough discussion of the computer dispersion models, methods, and significance of anticipated impacts and several worst case analysis are located in the appendix (see Air Quality Impact Analysis of the Hermit Project).

As stated in this report the proposed action would not have a significant adverse environmental impact on the immediate airshed classifications (Class II) nor the Class I airshed of the Grand Canyon National Park.

2. Climatology

The proposed action would have no effect on local or regional climatological patterns.

a. Precipitation

The proposed action would not affect local or regional precipitation.

b. Winds

The proposed action would not affect local or regional wind patterns.

3. Air Quality

To determine the potential impacts of the proposed action on air quality, extensive computer modeling was undertaken using actual meteorological data, emission inventories and emission rates. These studies were conducted to determine actual impacts as well as projected "worst case" impacts under extremely conservative assumptions.

These studies show that the proposed action including mine yard and haul road activities would not create impacts that would approach or exceed any substantial air quality standards or mandates. The Air Quality Impact Analysis is located in the appendix.

4. Surface Hydrologic Impacts

Flooding Potential

With the diversion ditches designed to pass the 100-year flood peaks and additional freeboard provided in the channel design and that available due to the proposed dike, no flood damage is expected to any facility at the mine site. Because of available freeboard, the mine site facilities are flood proof for much more severe floods than the 100-year event. Some overland and overbank flooding may occur, during the 500-year storm event on the channel flank farther from the site boundary. However, this overbank flooding is not expected to be more severe than that expected under the existing conditions. At present, the entire storm runoff from sub-watersheds A and B runs through natural depressions or rills or as overland flow. The construction of the proposed ditches will channelize flood flows and minimize overland flow and the associated soil erosion. Any overbank flows spilling over the channel banks would be much less than the overland flows without the ditches (i.e., under existing conditions).

The on-site retention pond has a capacity to store more than the volume of the 500-year 24-hour storm runoff from the Project Area. Therefore, the flooding potential downstream of the mine site would be somewhat attenuated and the streamflows would be somewhat reduced. However, the area of subwatershed C, from which the surface runoff would be contained is only 8.3 percent of the total area of the watershed contributing runoff to the point immediately downstream of the Project Area. Therefore, the overall impact at this location would be minimal and would become insignificant at points further downstream.

Erosion Potential

With the riprap and or vegetation proposed along the inner banks of the diversion ditches, the potential for bank erosion would be minimized. Some erosion may be expected on the outer (unprotected) banks of these diversion ditches. However, the channel velocities for the most extreme flood events are in the range of 4.5 to 5.0 ft/sec as compared to the reported non-scouring velocities of 2 to 3.5 ft/sec for channels excavated in alluvial silts (Chow, 1959). Therefore, the erosion potention during most flood events is expected to be minimal.

Any flood induced erosion within the Project boundary would be contained and therefore the impact of this erosion on the surrounding surface water environment would be insignificant.

Accidental Release of Contaminants

As described in the previous sections, with the proposed design criteria, the probability of any eroded or accidentally released contaminant getting out of the site area is extremely remote. To analyze a hypothetical scenario, it is postulated that some amount of contaminated liquid gets released into the surrounding surface water environment, during an unexpectedly severe event, e.g., in excess of the design standard. This volume of contaminated liquid would first be diluted by the estimated 2.95 acre-ft of runoff volume generated within the Project Area. Further dilution would be provided by an additional total runoff volume of 30.18 acre-ft from subwatersheds A and B by the time the contaminant reaches the downstream end of the mine site area. This would provide an additional dilution factor of about 11.2. Further dilution will be available when the contaminant reached Bulrush Canyon and a dilution factor of about 2700 would be available in Kanab Creek giving a total dilution factor of about 24,000 between the concentrations in the water getting out of the

mine site area and that flowing down Kanab Creek. It may be noted that the drainage area of Kanab Creek near Fredonia is 1,085 sq. miles compared to a total drainage area of 0.388 sq. mile for the subwatersheds upstream of the outlet point of the mine site area (USGS, 1979). Therefore, it is expected that the available dilution factors in Kanab Creek under other flow conditions would also be of the same order of magnitude as for the storm exceeding the 500-year event.

5. Groundwater Impacts

Experience to date has shown that the rates of ground-water inflow to the existing mines in the Kanab Plateau decrease with time and are small, that is less than 5 gallons per The proposed depth of mining within the mineralized portion of the breccia pipe at the Hermit site would be approximately 1,000 feet above the regional ground-water table within the Redwall-Mauv aquifer. Laboratory tests on rock core from within the breccia pipe but below the depth of uranium mineralization have shown the rock mass to be effectively impermeable. Measured hydraulic conductivities for the non-mineralized portions of the breccia pipe below the depth of mining were less than 1×10^{-8} cm/sec. This compares measured hydraulic conductivities of less than 1×10^{-9} cm/sec for the altered sandstone and siltstone units adjacent to, but outside of the breccia pipe and measured values of 2.0×10^{-7} to 1.4×10^{-6} cm/sec for non-mineralized portions of the pipe within the zone of mining.

Recementation of the collapse breccia within the pipe and the alternation and recementation of the sedimentary units immediately around the pipe have resulted in a very low permeability environment. Because of the very low permeabilities and the physical separation, the potential for any direct impact on water quality or quantity within the Redwall-Mauv limestone aquifer is negligible.

In addition to these physical factors which limit the potential for water quality or quantity impacts with the Redwall-Mauv aquifer, absorption of heavy metals and radioactive constituents on the surfaces of clays as well as chemical reactions with the rock strata would tend to minimize or eliminate any short-term or long-term potential water-quality impacts. Thick sequences of agrillaceous mudstones and limestones with high absorptive capacities physically separate the uppermost aquifer within the Redwall-Mauv limestones and the proposed depth of mining.

It can be expected that mine development may locally dewater perched ground-water systems which exist within the thick unsaturated zone above the regional water table. Any effect on these perched systems, however, would be limited to the immediate mine area. (See the Ground Water Impact, Assessment, Appendix),

6. Soils

Soil disturbance at the mine yard would consist of minor recontouring to internally drain the area towards the holding pond and the channelizing of the watershed around the mine yard. Top soil would be stockpiled causing and adverse changes in the microbial community. Once the area is reclaimed it is believed that due to the small size (less then 23 acres) of disturbance that the microbial population will restore itself rather quickly.

Soil erosion rates would increase during construction but considering the drainage plan proposed, soil loss from the surrounding area is anticipated to be insignificant. If soil erosion rates or soil loss from the site becomes a problem EFN would be required to correct it immediately.

On haul routes, soils would be compacted by the use of heavy equipment and other vehicle activities. Runoff from the road may increase soil erosion rates during periods of intense storm activities. The use of culverts and fill material should greatly reduce this risk and therefore the anticipated adverse impacts should be minimal, as well as temporary.

7. Geology/Topography

During Phase I and II, there would be some change in relief (23 acres) of the project area. To accommodate full internal drainage of the mine yard, minor grading of the mine yard itself is necessary.

Upon cessation of operations, only minor changes in the pre-mining contours would occur. As revegetation proceeds, these changes should be unnoticeable to the average visitor.

Additionally, given the stable nature of the local stratigraphy, there is virtually no probability of a "collapse" that might manifest itself on the areas surface topography.

8. Radiological Impacts

Based on the evaluations of direct radiation, radon, dust emissions and ore hauling within the Radiological Assessment of the Hermit Project (Appendix) and the commitment of EFN to not allow any liquid releases from the mine yard, there is not expected to be any significant adverse radiological impacts to the surrounding area, to visitors, local inhabitants or the mine workers.

During mine operation, the impact from ore piles and releases to the air from vent shaft would not be measurable at distances greater than a few hundred meters from the mine yard. Nor would it be possible to distinguish between mine induced radiation from natural background radiation in the environment. The complete Radiological Assessment of the Hermit Project is located in the appendix document.

9. Acoustical Impacts

Based on similar studies at other mines in the District (Pinenut and Hack Canyon), significant audio-impacts are not anticipated. Those impacts that are anticipated are within applicable limits set for safety standards.

Nor is it anticipated that accoustical effects would have significant negative impacts on recreation due to extremely low use of the area and the fact that higher recreation values are found elsewhere. For comparative purpose see the Pinenut Environmental Assess Acoustical Impacts section.

Based on similar operations and experiences of the U.S. Forest Service at the Canyon Mine, noise from hauling is not expected to have significant adverse impacts on wildlife species.

C. Living Environment

1. Wildlife

a. Big Game

It is anticipated that the proposed action would have only a very minor negative impact on mule deer and antelope for the duration of this project. The combination of low densities of mule deer and antelope, lack of water and cover in the immediate area and the

small amount of surface disturbance associated with the mine yard and haul road does not lend itself to significant adverse impacts.

The increased sights, sounds and smells of human activities are not expected to significantly interrupt daily movements and use of the immediate area by big game due to such low densities of these species.

Impacts are expected to increase slightly in magnitude during Phase II. These impacts would be associated with the construction of the new haul road and actual hauling activities.

The probability of direct mortality to deer or antelope as a result of a vehicle collision is extremely remote and considered insignificant.

No impacts to recent or future transplants of bighorn sheep in Hacks Canyon or Kanab Creek are anticipated.

b. Birds of Prey

This project is expected to have no significant adverse impacts on golden eagle (protected) or peregrine falcon (endangered), as this area contains no suitable nesting areas.

Minor insignificant adverse impacts may occur to other raptor species due to the loss of 23 acres (+) of habitat/prey base.

The chance for future adverse impacts is also considered extremely remote. The actual mine yard and hauling areas are far enough removed from known habitat or sightings as to have a negligible impact on any species.

Impacts to the prey base and consequently the effects on other raptors should also be insignificant, given the small amount of area affected, other remaining existing habitat, and the temporary nature of operations.

c. Non-Game

Loss of 23 acres and 1.2 miles of access would destroy approximately 23 acres of habitat, including food, cover, burrowing and nesting sites of small animals as well as direct mortality. Impacts may be adverse, but are considered insignificant due to the small amount of habitat actually disturbed. In addition, when

reclamation is accomplished, it is expected, the area would support at least the original populations that existed in the predisturbed conditions.

Increased vehicle traffic and human/wildlife encounters along the aligned road could result in shifts in wildlife use patterns and avoidance of the road area.

2. Vegetation

Negative impacts would result when the mine yard is cleared and graded to insure internal drainage. This impact would involve approximately 23 acres of vegetation in the mine yard plus an additional 5 acres due to the construction of 1.2 miles of access. Although the direct impact to the area of disturbance is severe the overall impact is insignificant due to the abundance of identical habitat.

3. Threatened & Endangered Species

There would be no direct impact to any Threatened or Endangered or Candidate Categories (1,2) plant species as a result of this project. Additionally, no Threatened or Endangered wildlife species would be impacted.

D. Human Values

1. Cultural Resources

As stated in the existing environment, no significant cultural resources or sites were identified during the Class III inventories conducted around the mine yard or the proposed access road.

As a courtesy, the State Office Historical Preservation Officer has been sent a copies of the inventory report for their records.

Due to the absence of cultural resources in the area, there is no known potential for indirect impacts to any known cultural property.

2. Socio-Economics Impacts

This proposal should have no direct effect on the actual population of the local communities. EFN will utilize employees from the soon to be reclaimed Hack Canyon Mine. Some of the employees have already been hired to the Pinenut project.

Positive benefits would accrue, when additional people are hired from the unemployed workforce during Phase II. In addition, increased employment translates into continued support of local services not associated with mining (i.e., manufacturing, construction, public utilities and wholesale/retail trades and local tax base also).

Further benefits would be gained by the State of Arizona and local counties through an increased tax base.

3. Public Attitudes

Implementing the proposed action would create no significant changes in public attitudes. However the intensity and extent to which each side is voicing their opinions is expected to increase.

There has been and still is strong local support in Kanab, Fredonia, Colorado City, Blanding, Monticello and Bluff for the proposal due to the benefits derived from employment and the increased tax base. This is supported by in excess of 200 plus unsolicited letters from people, businesses and local government groups expressing support for the Hermit Mine and EFN. In addition approximately 10 unsolicited letters have been received requesting BLM to prepare an EIS on mining. BLM has responded individually to this last group of people. Interestingly, the letters requesting the Regional EIS were from residences of Washington, Oregon and New Mexico states.

4. Wilderness

The proposed action is not expected to have any direct effects on the Kanab Creek Wilderness Areas. Mining activities should not be visible or audible from the wilderness area.

5. Visual Resources

The mine yard would not be visible from the Travel Influence Zone on Mt. Trumbull Road.

However, this activity would represent the first action that could be seen from great distances. It is suspected that the upper portion of the head frame may be visible from Mt. Trumbull Road, but should constitute only an insignificant adverse impact because it should not dominant the land form or appear on the skyline. The mine yard may be visible from a small portion of State Highway 389 some 12 miles to the North. It is doubtful the visual impacts would be recognized as a mining activity but only as a disturbance or group of structures. The visual impact at these distances would be minimial.

Hauling activities and fugitive dust from the mine yard should not create a significant adverse impacts to visibility in the area (see Air Quality Impact Analysis in the appendix). The increase in 12 trucks per day plus support activities should be for below that which was achieved during the production at the three Hack Canyon Mines.

6. Other Values

Ranching

It is anticipated this action would have only a minimial effect on local ranching operations. If approved, EFN would remove their temporary water well and remove the existing tank to an area inside the mine yard to provide storage capacity for the new water well. Additionally, the windmill (permittee properties) would be removed to another location. EFN has offered the use of additional water from the new well via a trough outside of the mine yard which should provide the ranchers with a more reliable water supply than previously existed.

Some ranchers may perceive a new road to the site as a negative impact because it opens up the area to potential vandalism of livestock improvements.

Recreation

The proposed action would have a negative effect on recreationists who have traditionally perceived the Mt. Trumbull Road as a scenic corridor and gateway to the Grand Canyon National Park.

Generally however, this action would have no direct effect on the majority of recreational opportunities on the District.

Furthermore, the very thought of new construction on the Arizona Strip is preceived as a major adverse impact to many back country users.

E. Cumulative Impacts

With the addition of Hermit Mine, the total cumulative surface disturbance resulting from mining operations would be increased by 23.6 acres. Approximately 1.2 miles of road would be upgraded.

Total mining disturbance would equal the following:

Mine yard access:	138.0 acres
Miles of powerline:	38.8 miles
New access constructed:	4.22 miles
Access upgraded:	38.0 miles

Based on the above, total cumulative disturbance from mining

operation results in approximately 0.005% of the entire Arizona Strip. It is not anticipated that the Hermit Mine would cause any form of cumulative impacts that would correlate with any other Uranium mines based on the data provided in this Environmental Assessment.

For example, fugitive dust and radiological impacts are limited in extent to a certain periphery of the surrounding mine yard and haul routes. Thus those impacts do not translate into area wide impacts regarding air quality.

Hauling would cause a short term impact on the Mt. Trumbull road for the duration that the Hermit Mine is in development or production. This amount of hauling would be less than that which occurred when the three Hack Canyon Mines were in production.

No environmental threshold or standards should be exceeded under normal operations.

VI. IMPACTS RESULTING FROM PROPOSED ALTERNATIVES

A. The No Action Alternative is a continuation of existing conditions. The impacts would be those resultant from the original exploration plan of operation and none of the impacts described in Section V (Anticipated Impacts) would take place.

The environmental impacts would be those resulting from the previously approved plan of operation and the existing exploration activities. Rehabilitation requirements would be those described in the original environmental assessment.

B. Alternative 2. The Proposed Action would be approved as submitted. The resulting impacts would be those described in Section V above.

C. Alternative 3. The proposed action would be approved subject to additional modifications, mitigation or stipulations, including but not limited to the following.

1. Require use of one of two alternate access to the site (See Figures 11, and 12).

The first access alternative (No. 1) would deny use of the proposed access and require that EFN use the existing access to the site. This would necessitate approximately 3.5 additional miles of upgraded road as well as a greater visual impact due to the accute angle of the intersection at Mt. Trumbull Rd. Several areas on this existing access would have to be ripped or blasted because of minor rock formations and ledges. This would be adverse to local wildlife populations because of the intensity of sound levels. Additionally,

slightly more fugitive dust would be dispersed into the airshed as a result of hauling the longer distance. Several large curves would also have to be straightened to fascilitate safety of hauling and others using the road. A greater amounts of culvert work would also be necessary due to crossing more nature drainages.

Even though part of this access was originally constructed for exploration, it would not seem to be the minimum necessary (in terms of environmental impacts) to achieve access to the site for the purposes operating the mine.

The 2nd alternative access would require upgrading of 3.5 miles of existing road. Since the access enters south of the project area, additional hauling distances on Trumbull Road would occur, which would result in more fugitive dust.

Each access alternative (1 and 2) would result in 3.5 and 4.5 miles of additional disturbance (upgrading) respectively than would the proposed access (1.2 miles).

Either alternative access could result in a potential increase in public use to other areas beyond the mine (i.e., Sunshine Point and Gramma Canyon, etc). While additional visitation to these scenic areas are not necessarily a negative impact, there would be a potential for increased vandalism to cultural sites or livestock improvements.

The following impacts would occur on any alternative chosen. However the magnitude of the impact is also a function of the distance travelled.

Blading would destroy vegetation completely. Heavy equipment would compact surface areas and consequently runoff and erosion would increase. The effects of which could be mitigated to insignificance via proper road design and standards.

Access alternatives 1 and 2 would also result in greater negative impacts to small burrowing or nesting animals.

2. This Alternative would require alternate forms of transportation of employees to the project area.

a. Deny bussing of employees and require use of private vehicles.

This alternative could result in 128 vehicle trips per day during Phase I and slightly less than that during Phase II. Additionally a parking lot would be required that would add

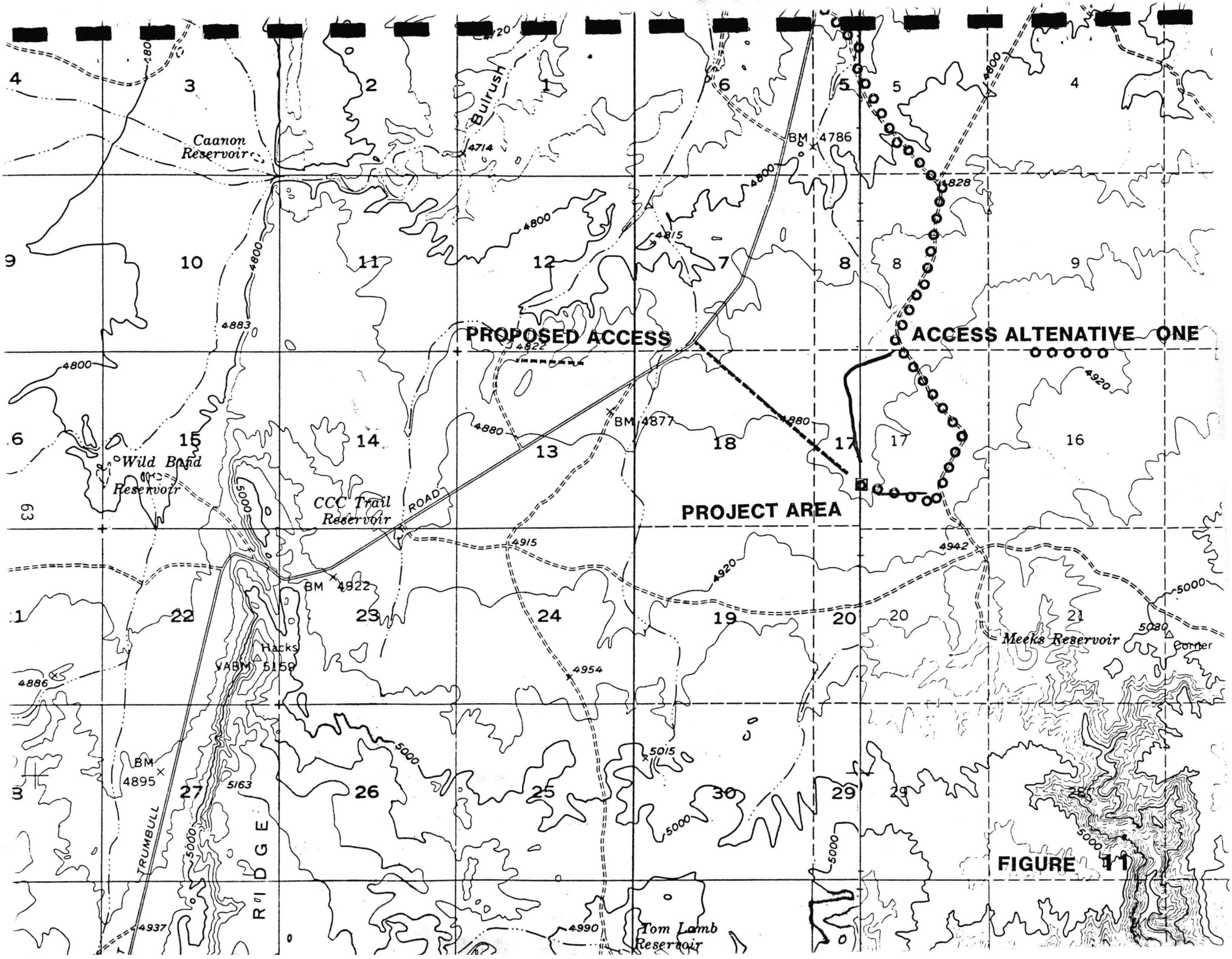

PROPOSED ACCESS
ACCESS ALTENATIVE ONE
PROJECT AREA
Caanon Reservoir
Wild Boar Reservoir
CCC Trail Reservoir
Meeks Reservoir
Tom Lamb Reservoir
Bullrush
TRUMBULL RIDGE
ROAD
Hacks
VABM 5159
BM 4786
BM 4877
BM 4922
BM 4895
4714
4822
4883
4915
4942
4954
4990
5015
5163
4937
4886
5030
Corner

FIGURE 11

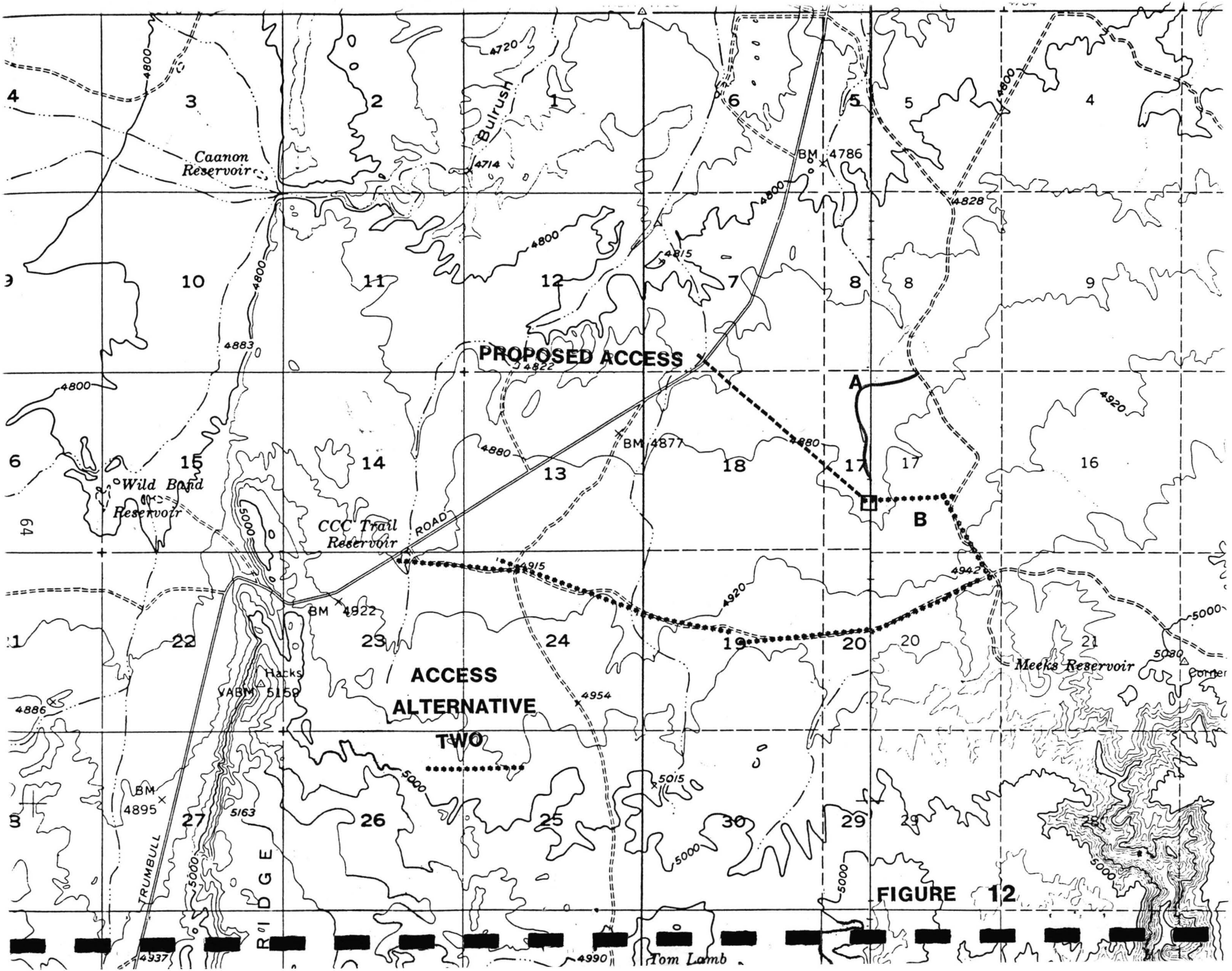

PROPOSED ACCESS
A
B
ACCESS
ALTERNATIVE
TWO
Caanon Reservoir
Bulrush
BM 4786
Wild Band Reservoir
CCC Trail Reservoir
ROAD
BM 4877
BM 4922
Hacks
VABM 5159
BM 4895
TRUMBULL
RIDGE
Meeks Reservoir
Tom Lamb
4720
4714
4800
4828
4815
4883
4822
4880
4920
4915
4942
5000
5080
4954
5015
5163
4886
4937
4990

FIGURE 12

additional surface disturbance and associated impacts to visual resources, vegetation removal, compaction/runoff, and erosion, wildlife and air fugitive dust quality.

In effect this is alternative defeats the objects of reducing traffic volumes and eliminating surface disturbance and air quality impacts.

b. Require personel to be transported by aircraft.

This alternative would result in the need for additional surface disturbance to accomodate an air strip. The use of aircraft would adversely effect recreation user, Peregrine falcon re-establishment, livestock, safety and wildlife. It is also doubtful that this alternative could be required as it would mostly likely violate the "reasonable access" provisions of the General Mining Laws. (Maley).

3. This Alternative would require relocation of surface facilities within the mine yard.

Because the ore body is stationary there are not many viable alternatives to evaluate regarding the mine yard. However some options were analyzed within the scope of this alternative.

a. Require ore piles to be located at the northern part of the mine yard. This alternative would result in ore storage at the lowest part of the mine yard. The area would be subject to runoff from within the yard and would preclude placement of the evaporation/holding pond where it would be most effectiving in gathering surface runoff. The potential for slightly more contamination of holding pond water would increase. In effort, this alternative would defeat the objective of keeping the ore piles in a topographically high part of the yard.

b. This would preclude proper placement of ore piles and would also possibly effect the placement of barren waste rock. It would affect proper storage of top soils which must be protected through out the duration of operations. Buildings that would not be in the higher areas of the yard would be subject to impacts from run off within the mine yard. This alternative would defeat the objectives of requiring surface facilities to be located in a limited compact area to reduce surface disturbance and would effectively cut down on the useable space in which heavy equipment could operate (ie, ore stock piling, loading areas, turn around areas, etc.).

c. Move the mine yard facilities within the surrounding area to the best suitable locations, (ie, ridge tops, flat area, etc.).

Require surface construction facilities to be placed along the east and/or west perimeters of the mine yard.

This would increase the size of the yard significantly making security and safety much less efficient. The beneficial impacts from reducing cut and fill operations would be off set by the disturbance from normal operations between the selected areas. The resulting impact would be greater in extent to all of the environmental parameters; surface disturbance, water, wildlife, noise, flooding, vegetative, air quality, soils, cultural resources and visual impacts. It would be less cost effective and increase the potential for accidents and environmental contamination through the sheer increase in the size of the mine yard area.

4. Other alternatives to the plan of operations include alterations regarding storage ponds.

   a. This alternative would require the construction of the Phase II evaporation pond during Phase I prior to any ore stockpiling on the surface.

      This action would result in an extra margin of safety that would allow for a hundred year event to be handled safely before any ore is stockpiled in the mine yard during Phase I. This would require greater surface disturbance in the mine yard during Phase I but because of the internal drainage design the impact would be insignificant.

   b. Require a larger or secondary overflow pond at commencement of Phase II.

      This action would eliminate the possibility that a storm larger than a 100 year 24 hour event would breach the storage capacity of the holding pond. It would reduce the possibility of overflow and downwash contamination. If the additional capacity could be obtained in the mine yard the increased disturbance would be insignificant. According to E.O. 11988 the 100 year/24 hour event is the federal government's requirement for this action. Therefore requiring greater capacity storage facilities would be difficult to enforce.

   c. This alternative would require oil/gas and diesel storage areas to be bermed to prevent accidental impacts on and off site.

      This action would provide an additional safety margin to prevent the release of contaminated liquid. Berm material is available on site and would result in no additional adverse environmental impacts.

5. This Alternative would require rehabilitation of the temporary exploration access roads.

This alternative would require the two temporary access presently existing to be rehabilitated. Access B (located on Figure 12) was the original temporary overland access to the exploration area. Access A was created by the permittee in the drainage area as an effort to utilize the temporary water source that EFN discovered during shallow exploration drilling. Additional positive affects would be the reduction of surface disturbance, increased visual enhancement and revegetation as well as a single restricted access to the mine site.

VII. Recommended Mitigating Measures to Enhance Environmental Protection

A. Mine Yard

1. If the protection of topsoil stockpiles becomes warranted in the future, EFN will consider use of a tacktifier/or asphalt emulsion to prevent wind erosion.

2. If protection of the stockpiled topsoil on the eastern edge of the yard becomes warranted because of channel or dike erosion, EFN will consider the use of rip rap on the edge of stockpiles closest to the drainage channels and dikes.

3. EFN should ensure that diversion channels and associated dikes (freeboard) are properly maintained throughout the duration of operations.

4. During reclaimation EFN should ensure that topsoils are equally distributed over the disturbed area to better insure proper reclamation.

5. Should periods of prolonged drought occur, EFN should implement a daytime dust abatement program within the mine yard as approved by the authorized officer.

6. Signs should be installed at the entrance of the mine yard and on Mt. Trumbull Road, to inform visitors and other land users that a uranium operation is in progress, in addition to the "No Trespassing" sign on the mine yard fences.

7. EFN should dispose of all concrete pads by breaking them up and back filling them into the mine shaft.

8. To be successfully rehabilitated, ground cover should be established to at least the prevailing conditions (i.e., 20 - 30% canopy cover) and approved by the authorized officer.

The following seeding mixtures and rates would be recommended:

Fourwing salt bush	2.0 lb./acre
Indian rice grass	2.0 lb./acre
Sand drop seed	0.5 lb./acre
Yellow Sweet Clover	0.5 lb./acre
Pubescent Wheat grass	2.0 lb./acre
Russian Wild Rye	2.0 lb./acre
TOTAL	9.0 lb./acre

This area would be expected to respond favorable to harrowing, seeding and chain dragging to cover seeds. Seedings should be planned to take advantage of optimum seasonal moisture conditions.

9. If the State of Arizona's Water Permit Unit determines that an NPDES permit or groundwater protection permit is necessary, then EFN is bound to the conditions of the permit.

10. EFN should report local sightings of falcon or eagle to BLM. Upon such a sighting, no employee will harass, harm or injure the specie.

11. EFN should ensure that the uranium ore stockpiles will not exceed the size of the ore pads.

12. Fuels and solvent storage area should be bermed to prevent accidental release of contaminated liquids.

13. The evaporation pond, dike, and diversion ditches should be routinely maintained to insure their integrity at all times during the operation of the mine with appropriate modifications during reclamation.

14. The roads and road crossings should be monitored for signs of erosion. If any erosional damage is detected, the same should be repaired by riprap or other erosion control measures.

15. All disturbed areas and channel banks (when required) should be properly vegetated to establish satisfactory vegetation cover.

B. Access

1. All road upgrading or construction must at least conform to BLM standards.

2. Any culverts necessary must be sized according to the expected maximum drainage flow and installed according to at least BLM standards.

3. Doublewide cattleguards will be placed at the fence, intersected by the proposed road, for the duration of operations.

4. The proposed access (if allowed) should be fully rehabilitated subject to the discretion of the Authorized Officer.

5. During road construction or upgrading, no actions will be allowed that would have a potential to impact down wash flow, existing reservoirs, etc.

6. The road that is ultimately selected as the haul route should be appropriately graveled to reduce air quality impacts. If absolutely necessary, EFN will conduct dust abatement on the access to the mine site.

7. Road upgrading on that portion of the access road visible from Mt. Trumbull road should be limited to the minimum necessary to meet safety standards. This will help discourage visitor use of the access road that leads exclusively to the mine yard.

8. The haul road access should intersect Mt. Trumbull road at/or close to 90 degree intersection to enhance safety and reduce visual impacts.

C. Aircraft Use

1. EFN should not utilize Kanab Creek Canyon as a flight path to the Hermit Mine yard.

D. Radiological Impacts

1. All operations at the Hermit Mine shall comply with all pertinent Federal and State laws regarding radiological impacts; including but not limited to:

   - ARS-27-31, Concentration of radon gas shall not exceed such amount as may be set by the mine inspector.

   - ARS-27-372, in all uranium operations the operator shall test regularly for radon daughter concentration and submit test records of testing as may be required by the State Mine Inspector.

   - R11-1-473, smoking is prohibited where uranium is mined.

   - R11-1-472, when radon daughter contrations are above 0.1 WL in active working ares, measurements representative of the workers breathing zone shall be determined. Sample dates, locations and results shall be determined, recorded and retained at the mine office for at least two years.

E. Visual

1. Buildings and head frames should be painted a flat earth tone to be more harmonious with the existing environment.

2. Impacts of noticeable "night lights" should be "hooded and directed" to throw light within the area of operations.

F. Accidental Release

1. In the remote event that any liquid from within the mine yard is released off site, EFN will take immediate actions for cleanup, including a final radiological assessment of the impacted area that will be submitted to BLM.

   If additional reports are required by the State of Arizona (i.e., Best management Practices Plan or Best Available Technology Plan), they should be forwarded to BLM.

2. In the remote event that ore is spilled, EFN will immediately contact BLM and provide them with applicable reports on the incident, as soon as possible.

G. Other

1. EFN is responsible for any damages to livestock operations caused by their operations.

VIII. Residual Impacts

Until reclamation efforts prove successful, the following residual impacts are expected.

Mine yard: A nominal amount of soil loss is expected until revegetation efforts become established.

Access: Minor or insignificant amounts of erosion are expected until revegetation is successful. Visual impacts of the access are mostly limited to the road area itself or when passing the access on Trumbull road.

Visual Resources: Results of human activity will be noticeable for several years, until reclamation is successful.

IX. Relationship Between Short Term Use and Long Term Productivity

The short duration of this project is not expected to have any adverse impact on the long term productivity of the area as reclamation efforts are designed to return the area to approximately the prevailing conditions.

X. Irreversible and Irretrievable Commitments

As a result of this project, uranium ore will be extracted and processed thus constituting an irretrievable commitment.

XI. Agencies and People Consulted

A. Mailing List Soliciting Comments

Approximately 480 individuals, groups, organizations and agencies were solicited to provide comments on this EA, including individual and environmental interests as well as local, state and Federal interests. Out of 480 solicitations, approximately 180 people/organizations, have requested the E.A. for comment.

B. Agencies/Groups Consulted

On March 17, 1987, BLM and EFN presented the Hermit mine plan-of-operations, on site, to the following list of agencies and interested parties. BLM solicited concerns from the group after the presentation. As of that time there were no agency concerns over those presented by BLM.

BLM - Arizona

District Staff

Cloyd Swapp - District Geologist
Ken Moore - Environmental coordinator
Julian Anderson - Assist., D.M., Resources
Bob Smith - Hydrologist
Ron Ray - Computer/Landscape Architect
Lee Hughes - Supervisory Range Con/T&E Specialist
Rob Roudabush - Area Manager
Mike Small - Wildlife management Biologist
Ilene Anderson - Lands and Realty
Tom Folks - Recreation/Wilderness
Bob Sandberg - Lead Range Conservationist
Jennifer Jack - Area Archeologist
Timothy Duck - Wildlife Management Biologist
Jack Johnson - Natural Resource Specialist
Scott Spooner - Geologist

State Office Staff

Keith Pearson - Environmental Coordinator
Dan McGlothlin - Hydrology/Soils
Alan Rabinoff - Minerals
Gary Stumpf - Archeologist

Other Federal Agencies

Grand Canyon National Park, John Ray - Resource Manager
Grand Canyon National Park, Mike Ebersol - Tuweep Ranger/Pilot
U.S. Fish and Wildlife Service, Don Metz - Assist. Field Supervisor
U.S. Forest Service (N.K.R.D.), Steve Martinet - Recreation and and Lands Staff

Kaibab Paiutes

Vivian Jake - Tribal Cultural Consultant Representative
Troy Jake - Tribal Manager

State Agencies

Arizona Game and Fish Dept.

Don Randall - Wildlife Manager

Arizona Department of Health Services

Gary Ullinsky - Environmental Health Specialist
Miguel A. Santiago - Environmental Health Specialist

Air Quality Dept.

Water Quality Bureau (Northern Regional Office)

Water Permits Unit

Arizona State Historical Preservation Officer

Mining Company's

Pathfinders, Dieter Krewedl
Rocky Mtn. Energy, W. Cary Voss
Energy Fuels Nuclear, Brad Doores

Grazing Permittee

Fred Heaton

BLM will utilize the Arizona State Clearing House to ensure the review of this document by all appropriate Arizona State Agencies and Regional Council's of Government pursuant to Executive Order 12372.

XII. Source Materials

1. Plan of Operations for the Hermit Project (EFNI, Feb. 1987).
2. Air Quality Impact Analysis of the Hermit Project (EnecoTech Inc., Feb. 1987)

3. Radiological Assessment of the Hermit Project (McKlveen, 1987)
4. Hydrologic Evaluations For the Proposed Hermit Uranium Mine In Mohave County, Arizona (Dames and Moore, Feb. 1987; Job No. 09973-033-030).
5. Hermit Mine Ground-Water Conditions (Dames and Moore; March 1987).
6. Wildlife Inventory and Analysis; (Sigler Associates, Feb. 1987).
7. Code of Federal Regulations, 43 CFR; 3809
8. Code of Federal Regulations, 40 CFR; 116 "Designation of Hazardous Substances"
9. Code of Federal Regulations, 40 CFR, 122 "National Pollutant Discharge Elimination System"
10. Arizona Environmental Quality Act - An Overview Section B. Groundwater Quality Provisions and Water Quality Standards. by: David S. Baron
11. House Bill 2518, An Act; State of Arizona House of Representatives, Thirty-seventh legislature, Second Regular Session, 1986.
12. Impacts of Uranium Mining and Milling Upon the Fish and Wildlife Resources of the New Mexico San Juan Basin. (Biological Services Program; Fish and Wildlife Service; FWS-80/56; September 1980).
13. An Environmental Guide to Western Surface Mining, Part Two: Impacts, Mitigation and Monitoring (Biological Services Program; Fish and Wildlife Service; FWS/OBS-78/04; December 1977).
14. Birds of the Arizona Strip, U.S.D.O.I., Bureau of Land Management (U.S.G.P.O. 1978-786-167).
15. Reptiles and Amphibians of the Arizona Strip, U.S.D.O.I., Bureau of Land Management (U.S.G.P.O. 1978-786-167).
16. Mammals of the Arizona Strip, U.S.D.O.I., Bureau of Land Management (U.S.G.P.O. 1978-788-167).
17. Clayhole Habitat Management Plan
18. Pinenut Final Environmental Assessment (May 1986).
19. District Management Framework Plan
20. Glossary of Surface Mining and Reclamation Technology, National Coal Association for the Coal and Environment Conference and Exposition; Louisville, Kentucky; October 22-24, 1974.
21. Anatomy of a Mine from Prospect to Production; U.S.D.A. Forest Service, General Technical Report, INT-35, Revised July 1983.
22. Hacks Canyon Allotment Management Plan, for Meeks Reservoir Pasture.
23. Revegetating Lands Disturbed by Mining in the Southwest. (U.S.D.A. - Soil Conservation Service -- Portland, OR. 1977).
24. Vegetative Rehabilitation and Equipment Work Shop, 39th Annual Report; December 1985.
25. Manual of Revegetation Techniques; (U.S.D.A. - Forest Service, May 1984 - 7100; Engineering; 8471 - 2600.
26. Reclaiming Disturbed Lands; (U.S.D.A. - Forest Service, November 1984;2200; Range 8422-2805)

27. Hydrologic Risk and Return Period Selection for Water Related Projects; (Bruce P. Van Haueven; U.S.D.O.I., BLM September 1979).
28. BLM Manual 8431 - Visual Resource Contrast Rating).
29. User Guide to Vegetation; U.S.D.A. - Forest Service General Technical Report INT-64
30. User Guide to Hydrology; U.S.D.A. - Forest Service General Technical Report INT-74
31. Reclaiming Disturbed Lands; U.S.D.A. - Forest Service November 1984; 2200-Range;8422 2805
32. Upper Guide to Soils; U.S.D.A. - Forest Service General Technical Report INT-68
33. User Guide for Mining and Reclamation; Wildlife; U.S.D.A. - Forest Services General Technical Report INT-126
34. User Guide to Engineering; U.S.D.A. - Forest Service General Technical Report INT-70
35. Proceedings of the Uranium Mining and Milling Workshop, Biological Services Program; FWS/OBS-80-57 August 1980
36. Opportunities for U.S. Fish and Wildlife Initiatives Relating to Uranium Mining and Milling in The Western United States (by: Gerald C. Horak et al.; Enviro Control, Inc., Fort Collins, Colorado).
37. Canyon Mine EIS; U.S.D.A. - Forest Service
38. Jackpile-Paguate-Uranium Mine Reclamation Project EIS - 1985 (U.S.D.O.I. - BLM February 1985).

File Divider Page

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300. GOLDEN, COLORADO 80401 PHONE (303) 277-1687

22-May-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 3
Set : 1

Attn:
Project: Hermit Min PO #:

Received: 3-May-91 10:06

Job: 91830E Status: Final

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm
HER100	162	162	<1	40	7.56	2580

Sample	TDS mg/l	TSS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l
HER100	3360	17	<0.1	<0.1	2270	12.7

Sample	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l
HER100	<0.01	<0.001	0.01	579	0.009	0.01

Sample	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER100	<0.01	1.5	7.07	<0.02	191	0.09

Sample	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l
HER100	<0.0002	21.7	<0.001	75.1	<0.005

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ
HER100					3.5	±0.7

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

BARRINGER LABORATORIES INC.
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Attn:
Project: Hermit Min

Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

Sample Type: Water

Sample	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER100	0.0	±0.5	0.0016

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PO #:

Job: 91830E

Status: Final

Abbreviations:

Parameters:

HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230

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22-May-91

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Attn:
Project: Hermit Min PO #:

Received: 3-May-91 10:06

Job: 91830E Status: Final

U : Uranium

Units:

mg/l : milligrams per liter
µmho/cm : micromhos per centimeter at 25C
pCi/l : picoCuries per liter
2σ : Counting error at the 95% confidence level, 2σ

Quality control:

< : less than

Signed: Lyle Ryman / Ellen La Riviere
Lyle Ryman / Ellen La Riviere
Laboratory Managers

BARRINGER LABORATORIES INC.
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22-May-91

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Project: Hermit Min

Received: 3-May-91 10:06

PO #:

Job: 91830E

Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l
Duplicate	192	192	<1	28
Duplicate	192	192	<1	28
Duplicate % diff.	0.0	0.0	0.0	0.0
Std (actual value)	---	---	---	58
Std (expected value)	---	---	---	50
Std % diff.	---	---	---	16
Blank	---	---	---	---
Spike Recovery %	---	---	---	109

Sample Id	pH unit	Specific Conductance µmho/cm	TDS mg/l	TSS mg/l
Duplicate	7.56	---	3360	17
Duplicate	7.56	---	3360	17
Duplicate % diff.	0.0	---	0.0	0.0
Std (actual value)	---	1420	1770	---
Std (expected value)	---	1413	1742	---
Std % diff.	---	0.5	1.6	---
Blank	---	---	---	---
Spike Recovery %	---	---	---	---

Sample Id	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l
Duplicate	0.7	<0.1	2330	9.38
Duplicate	0.7	<0.1	2320	10.6
Duplicate % diff.	0.0	0.0	0.2	6.1
Std (actual value)	2.06	0.54	1300	1.23
Std (expected value)	1.98	0.50	1234	1.19

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Page: 2
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Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l
Std % diff.	4	8	5.3	3.4
Blank	---	---	---	---
Spike Recovery %	112	83	---	*

Sample Id	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l
Duplicate	<0.01	<0.001	<0.01	438
Duplicate	<0.01	<0.001	<0.01	510
Duplicate % diff.	0.0	0.0	0.0	7.6
Std (actual value)	1.00	0.110	1.10	237
Std (expected value)	0.97	0.100	1.02	250
Std % diff.	3.1	10	7.8	5.2
Blank	---	---	---	---
Spike Recovery %	90	76	113	94

Sample Id	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l	F mg/l
Duplicate	<0.005	<0.01	<0.01	---
Duplicate	<0.005	<0.01	<0.01	---
Duplicate % diff.	0.0	0.0	0.0	---
Std (actual value)	0.217	0.206	0.199	10.0
Std (expected value)	0.200	0.200	0.200	10.0
Std % diff.	8.5	3.0	0.5	0.0
Blank	---	---	---	---
Spike Recovery %	95	93	90	90

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Attn:
Project: Hermit Min PO #:

Received: 3-May-91 10:06

Job: 91830E Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
Duplicate	4.18	<0.02	221	0.04
Duplicate	4.96	<0.02	258	0.04
Duplicate % diff.	8.5	0.0	7.1	0.0
Std (actual value)	0.184	0.191	2.02	0.202
Std (expected value)	0.200	0.200	2.00	0.200
Std % diff.	8.0	4.5	1.0	1.0
Blank	---	---	---	---
Spike Recovery %	92	75	97	89

Sample Id	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l
Duplicate	<0.0002	25.8	<0.001	189
Duplicate	<0.0002	31.2	<0.001	226
Duplicate % diff.	0.0	9.5	0.0	8.9
Std (actual value)	0.0049	11.3	22	240
Std (expected value)	0.0050	10.6	25	250
Std % diff.	2.0	6.6	12	4.0
Blank	---	---	---	---
Spike Recovery %	116	105	76	102

Sample Id	Zn Total mg/l	Gross Alpha Error Total pCi/l	2σ	Gross Beta Error Total pCi/l	2σ
Duplicate	0.014	0	±28	27	±18
Duplicate	0.014	5	±28	29	±18
Duplicate % diff.	0.0	100	---	3.6	---
Std (actual value)	0.193	202	±5	104	±2
Std (expected value)	0.200	206	---	106	---

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QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ
Std % diff.	3.5	1.9	---	1.9	---
Blank	---	0.0	±0.2	0.4	±0.4
Spike Recovery %	88	---	---	---	---

Sample Id	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
Duplicate	22	±3	0.0	±0.5	0.0021
Duplicate	22	±3	0.0	±0.6	0.0020
Duplicate % diff.	0.0	---	0.0	---	2.4
Std (actual value)	105	±4	101	±3	33
Std (expected value)	101	---	98	---	34
Std % diff.	4.0	---	3.1	---	2.9
Blank	0.0	±0.2	0.0	±0.2	<0.0003
Spike Recovery %	---	---	---	---	---

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PO #:

Job: 91830E

Status: Final

QUALITY CONTROL REPORT

Abbreviations:

Parameters:

HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
Ra-226	: Radium-226

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Attn:
Project: Hermit Min

Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

QUALITY CONTROL REPORT

Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ	: Counting error at the 95% confidence level, 2σ

Quality control:

*	: Sample > 4 times spiked value.
<	: less than

Signed: Stephen A. Nelson

Approved
Quality Assurance Department

BARRINGER LABORATORIES INC.
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22-May-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 7
Copy: 1 of 3

Attn:
Project: Hermit Min PO #:

Received: 3-May-91 10:06

Job: 91830E Status: Final

QUALITY CONTROL REPORT

QUALITY CONTROL DATA SHEET

Received by: ljb Via: UPS

Sample Container Type: lg cu, L cu
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Sprague	5/7
HCO3	1	210.1	1 mg/l	3	Sprague	5/7
CO3	1	210.1	1 mg/l	3	Sprague	5/7
Cl	1	325.2	1 mg/l	3	Kidwell	5/7
pH	1	210.1	.01 unit	3	Sprague	5/7
Specific	1	120.1	.001 µmho/cm	3	Ryman	5/15
TDS	1	160.1	4 mg/l	3	Swanson	5/7
TSS	1	160.2	4 mg/l	3	Swanson	5/7
NO3 as N	1	353.1	.1 mg/l	2	Anshutz	5/10
PO4	1	365.1	.1 mg/l	3	Anshutz	5/10
SO4	1	375.3	4 mg/l	3	Swanson	5/7
SiO2	1	200.7	.01 mg/l	1	Gilleland	5/16
Ag	1	200.7	.01 mg/l	1	Gilleland	5/16
As	1	206.2	.001 mg/l	1	Sprague	5/9
Ba	1	200.7	.01 mg/l	1	Gilleland	5/16
Ca	1	200.7	.01 mg/l	1	Gilleland	5/16
Cd	1	200.7	.005 mg/l	1	Gilleland	5/16
Cr	1	200.7	.01 mg/l	1	Gilleland	5/16
Cu	1	200.7	.01 mg/l	1	Gilleland	5/16
F	1	340.2	.1 mg/l	3	Pottruff	5/8
Fe	1	200.7	.01 mg/l	1	Gilleland	5/16
Pb	1	200.7	.02 mg/l	1	Gilleland	5/16

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Status: Final

QUALITY CONTROL REPORT

Mg	1	200.7	.01	mg/l	1	Gilleland	5/16
Mn	1	200.7	.01	mg/l	1	Gilleland	5/16
Hg	1	270.2	.0002	mg/l	1	Gilleland	5/10
K	1	200.7	.5	mg/l	1	Gilleland	5/16
Se	1	270.2	.001	mg/l	1	Sprague	5/10
Na	1	200.7	.01	mg/l	1	Gilleland	5/16
Zn	1	200.7	.005	mg/l	1	Gilleland	5/16
Ra-226	4,7,14	SM-705	0.2	pCi/l	1	Seidel	5/16-5/21
Th-230	11	---	0.2	pCi/l	1	Ortiz	5/7-5/14
U	4,9,10,14	ASTMD2907	0.3	mg/l	1	Meyer	5/16-5/17

cc: Bill Almas, ENERGY FUELS NUCLEAR

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

2-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

MAY 10

Page: 1
Copy: 1 of 3
Set : 1

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm
HER094	154	154	<1	41	6.84	2440

Sample	TDS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l	Ag Total mg/l
HER094	3250	<0.1	<0.1	2290	12.6	<0.01

Sample	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l
HER094	0.002	0.01	513	<0.005	<0.01	<0.01

Sample	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HER094	1.6	6.41	<0.02	161	0.09	<0.0002

Sample	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ
HER094	20.7	<0.002	68.6	<0.005	71	±31

Sample	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER094	27	±15	2.4	±0.5	0.0	±0.4	0.0027

BARRINGER LABORATORIES INC.
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2-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

Abbreviations:

Parameters:

HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
NO3 as N	: Nitrate
PO4	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

2-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 3
Copy: 1 of 3
Set : 1

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ	: Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed: Lyle Ryman / Ellen La Riviere

Lyle Ryman / Ellen La Riviere
Laboratory Managers

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

3-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l
Duplicate	154	154	<1	41
Duplicate	154	154	<1	41
Duplicate % diff.	0.0	0.0	0.0	0.0
Std (actual value)	---	---	---	52.5
Std (expected value)	---	---	---	50
Std % diff.	---	---	---	5
Blank	---	---	---	---
Spike Recovery %	---	---	---	---

Sample Id	pH unit	Specific Conductance µmho/cm	TDS mg/l	NO3 as N mg/l
Duplicate	6.84	2443	3250	<0.1
Duplicate	6.84	2467	3130	<0.1
Duplicate % diff.	0.0	1.0	1.3	0.0
Std (actual value)	---	---	1420	1.95
Std (expected value)	---	---	1479	1.98
Std % diff.	---	---	3.9	1.5
Blank	---	---	---	---
Spike Recovery %	---	---	---	---

Sample Id	PO4 mg/l	SO4 mg/l	SiO2 mg/l	Ag Total mg/l
Duplicate	<0.1	2290	12.6	<0.01
Duplicate	<0.1	2380	12.6	<0.01
Duplicate % diff.	0.0	1.9	0.0	0.0
Std (actual value)	0.52	1054	1.14	0.97
Std (expected value)	0.50	1000	1.19	0.97

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3-May-91

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P.O. Box 36
Fredonia, AZ 86022

Page: 2
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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	PO4 mg/l	SO4 mg/l	SiO2 mg/l	Ag Total mg/l
Std % diff.	4	5.4	4.2	0.0
Blank	---	---	---	---
Spike Recovery %	---	---	*	82

Sample Id	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l
Duplicate	0.002	0.01	513	<0.005
Duplicate	0.002	0.01	516	<0.005
Duplicate % diff.	0.0	0.0	0.3	0.0
Std (actual value)	0.093	1.07	1.91	0.192
Std (expected value)	0.100	1.02	2.00	0.207
Std % diff.	7.0	5.0	4.5	7.2
Blank	---	---	---	---
Spike Recovery %	---	96	*	103

Sample Id	Cr Total mg/l	Cu Total mg/l	F mg/l	Fe Total mg/l
Duplicate	<0.01	<0.01	1.6	6.41
Duplicate	<0.01	<0.01	1.6	6.42
Duplicate % diff.	0.0	0.0	0.0	0.1
Std (actual value)	0.183	0.187	10.1	0.196
Std (expected value)	0.200	0.200	10.1	0.200
Std % diff.	8.5	6.5	0.0	2.0
Blank	---	---	---	---
Spike Recovery %	97	96	100	*

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3-May-91

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P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
Duplicate	<0.02	161	0.09	<0.0002
Duplicate	<0.02	161	0.08	<0.0002
Duplicate % diff.	0.0	0.0	5.9	0.0
Std (actual value)	0.196	1.83	0.193	0.0050
Std (expected value)	0.200	2.00	0.200	0.0050
Std % diff.	2.0	8.5	3.5	0.0
Blank	---	---	---	---
Spike Recovery %	98	*	96	100

Sample Id	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l
Duplicate	20.7	<0.002	68.6	<0.005
Duplicate	20.6	<0.002	68.1	<0.005
Duplicate % diff.	0.2	0.0	0.4	0.0
Std (actual value)	11.4	0.027	1.18	0.193
Std (expected value)	10.6	0.025	1.12	0.200
Std % diff.	7.5	8.0	5.4	3.5
Blank	---	---	---	---
Spike Recovery %	103	---	*	100

Sample Id	Gross Alpha Error Total pCi/l	2σ	Gross Beta Error Total pCi/l	2σ
Duplicate	28	±15	20	±8
Duplicate	25	±16	26	±9
Duplicate % diff.	5.7	---	13	---
Std (actual value)	186	±5	108	±2
Std (expected value)	206	---	106	---

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3-May-91

Larry Casebolt
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P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ
Std % diff.	9.7	---	1.9	---
Blank	0.0	±0.2	0.0	±0.3
Spike Recovery %	---	---	---	---

Sample Id	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
Duplicate	2.1	±0.7	0.0	±0.6	0.438
Duplicate	2.5	±0.8	0.0	±0.6	0.438
Duplicate % diff.	8.7	---	0.0	---	0.0
Std (actual value)	95	±2	104	±3	35
Std (expected value)	101	---	98	---	34
Std % diff.	5.9	---	6.1	---	2.9
Blank	0.0	±0.1	0.0	±0.2	<0.0003
Spike Recovery %	---	---	---	---	---

BARRINGER LABORATORIES INC.
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3-May-91

Larry Casebolt
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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Abbreviations:

Parameters:

HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
NO3 as N	: Nitrate
PO4	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230

BARRINGER LABORATORIES INC.
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3-May-91

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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

U : Uranium

Units:

mg/l : milligrams per liter
µmho/cm : micromhos per centimeter at 25C
pCi/l : picoCuries per liter
2σ : Counting error at the 95% confidence level, 2σ

Quality control:

* : Sample > 4 times spiked value.
< : less than

Signed: .....
Approved
Quality Assurance Department

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

3-May-91

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ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

QUALITY CONTROL DATA SHEET

Received by: gr Via: UPS

Sample Container Type: lg cu, L cu
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Sprague	4/12
HCO3	1	210.1	1 mg/l	3	Sprague	4/12
CO3	1	210.1	1 mg/l	3	Sprague	4/12
Cl	1	325.2	1 mg/l	3	Anshutz	4/23
pH	1	210.1	.01 unit	3	Sprague	4/12
Specific	1	120.1	.001 µmho/cm	3	Anshutz	4/29
TDS	1	160.1	4 mg/l	3	Sprague	4/17
NO3 as N	1	353.1	.1 mg/l	2	Anshutz	4/16
PO4	1	365.1	.1 mg/l	3	Anshutz	4/9
SO4	1	375.3	4 mg/l	3	Sprague	4/17
SiO2	1	200.7	.01 mg/l	1	Hidalgo	4/10
Ag	1	200.7	.01 mg/l	1	Hidalgo	4/10
As	1	206.2	.001 mg/l	1	Gilleland	4/8
Ba	1	200.7	.01 mg/l	1	Hidalgo	4/10
Ca	1	200.7	.01 mg/l	1	Hidalgo	4/10
Cd	1	200.7	.005 mg/l	1	Hidalgo	4/10
Cr	1	200.7	.01 mg/l	1	Hidalgo	4/10
Cu	1	200.7	.01 mg/l	1	Hidalgo	4/10
F	1	340.2	.1 mg/l	3	Sprague	4/10
Fe	1	200.7	.01 mg/l	1	Hidalgo	4/10
Pb	1	200.7	.02 mg/l	1	Hidalgo	4/10
Mg	1	200.7	.01 mg/l	1	Hidalgo	4/10

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3-May-91

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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Mn	1	200.7	.01	mg/l	1	Hidalgo	4/10
Hg	1	245.1	.0002	mg/l	1	Gilleland	4/10
K	1	200.7	.5	mg/l	1	Hidalgo	4/10
Se	1	270.2	.001	mg/l	1	Gilleland	4/8
Na	1	200.7	.01	mg/l	1	Hidalgo	4/10
Zn	1	200.7	.005	mg/l	1	Hidalgo	4/10
Gross Alph	4	900.0	1.0	pCi/l	1	Seidel	4/11-4/18
Gross Beta	4	900.0	2.0	pCi/l	1	Seidel	4/11-4/18
Ra-226	4,7,14	SM-705	0.2	pCi/l	1	Howard	4/21-4/26
Th-230	11	---	0.2	pCi/l	1	Ortiz	4/10-4/16
U	4,9,10,14	ASTMD2907	0.3	mg/l	1	Meyer	4/29

cc: Bill Almas, ENERGY FUELS NUCLEAR

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1-Feb-91

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

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Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	CO3 as CaCO3 mg/l	HCO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l
HER073	161	<1	161	40	7.38	3470	3380

Sample	TSS mg/l	NO3 as N mg/l	PO4 as P mg/l	SO4 mg/l	SiO2 mg/l	As Total mg/l	Ba Total mg/l
HER073	<4	<0.1	<0.1	1830	13.0	0.002	0.01

Sample	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l	F mg/l	Fe Total mg/l
HER073	525	<0.005	<0.01	<0.01	1.5	9.47

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1-Feb-91

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: PO #:

Received: 26-Oct-90 15:23

Job: 903500E Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	K Total mg/l	Ag Total mg/l
HER073	<0.02	177	0.12	<0.0002	20.1	0.01

Sample	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HER073	<0.002	78.1	0.111	58	±26

BARRINGER LABORATORIES INC.
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1-Feb-91

Bill Almas
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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 26-Oct-90 15:23

PO #:

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Ra-228 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*
HER073	48	±14	3.2	±0.6	1.5	±1.3	0.0	±0.5

Sample	U Total mg/l
HER073	0.0009

BARRINGER LABORATORIES INC.
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1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: PO #:

Received: 26-Oct-90 15:23

Job: 903500E Status: Final

AMENDED REPORT

Abbreviations:

Parameters:

CO3	: Carbonate
HCO3	: Bicarbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4 as P	: Phosphate
SO4	: Sulfate
SiO2	: Silica
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Ag	: Silver
Se	: Selenium
Na	: Sodium
Zn	: Zinc

BARRINGER LABORATORIES INC.
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1-Feb-91

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Job: 903500E Status: Final

AMENDED REPORT

Ra-226	: Radium-226
Ra-228	: Radium-228
Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than
a	: Amended Value

Signed: Lyle Ryman / Ellen La Riviere

Lyle Ryman / Ellen La Riviere
Laboratory Managers

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1-Feb-91

Bill Almas
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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: PO #:

Received: 26-Oct-90 15:23

Job: 903500E Status: Final

AMENDED REPORT

QUALITY CONTROL DATA SHEET

Time Received: 15:23 Date: 10/26/90 Via: Federal Express

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Received: 1. HN03 2. H2SO4 3. none
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
As	1	206.2	0.001 mg/l	1	Gilleland	11/19
Hg	1	245.1	0.0002 mg/l	1	Anshutz	11/19
Se	1	270.2	0.002 mg/l	1	Gilleland	11/21
pH	1	150.1	0.01 unit	3	Hobbs	11/15
Cl	1	325.2	1 mg/l	3	Hobbs	10/31
Alk	1	210.1	1 mg/l	3	Hobbs	11/16
Sp. Cond.	1	1201	0.001 mg/l	3	Anshutz	11/19
F	1	340.2	0.1 mg/l	3	Anshutz	11/20
Ag	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Ba	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Ca	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Cd	1	200.7	0.005 mg/l	3	Hidalgo	11/21
Cr	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Cu	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Fe	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Pb	1	200.7	0.02 mg/l	1	Hidalgo	11/21

BARRINGER LABORATORIES INC.
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1-Feb-91

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1200 17th Street
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Denver, CO 80202

Attn:
Project:

PO #:

Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Ref	Method	LLD	Preservative	Analysis	Date(s) of Analysis
Mg	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Mn	1	200.7	0.01 mg/l	1	Hidalgo	11/21
K	1	200.7	0.5 mg/l	1	Hidalgo	11/21
Na	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Zn	1	200.7	0.005 mg/l	1	Hidalgo	11/21
SiO2	1	200.7	0.01 mg/l	1	Hidalgo	11/21
PO4	1	365.1	0.1 mg/l	3	Hobbs	11/1
NO3	1	353.1	0.1 mg/l	2	Hobbs	11/5
SO4	1	375.3	4 mg/l	3	Joy	11/10
TDS	1	160.1	4 mg/l	3	Joy	11/9
TSS	1	160.2	4 mg/l	3	Joy	11/10
Gr. Alpha	4	900.0	1.0 pCi/l	1	Seidel	11/19-11/21
Gr. Beta	4	900.0	2.0 pCi/l	1	Seidel	11/19-11/21
Ra-226	4,7,14	SM-705	0.2 pCi/l	1	Howard	11/15-11/19
Ra-228	12,13,14	904.0	0.9 pCi/l	1	Reyes	11/8-11/19
Th-230	11	---	0.2 pCi/l	1	Ortiz	11/6-11/13
U	4,9,10,14	ASTMD2907	0.3 µg/l	1	Tonning	11/12-11/14
Gr. Alpha(a)	4	900.0	1.0 pCi/l	1	Kidwell	1/22-1/25
Gr. Beta(a)	4	900.0	2.0 pCi/l	1	Kidwell	1/22-1/25

BARRINGER LABORATORIES INC.

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1455 QEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

24-Oct-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Page: 1
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Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

Sample Type: Water

Sample Id	Ag Dissolved mg/l	As Dissolved mg/l	Ba Dissolved mg/l	Ca Dissolved mg/l	Cd Dissolved mg/l
HER069 7/31/90	<0.01	0.001	<0.01005	632	<0.005

Sample Id	Cr Total mg/l	Cu Dissolved mg/l	F Dissolved mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l
HER069 7/31/90	<0.01	<0.01	1.5	12.7	<0.02

Sample Id	Mg Dissolved mg/l	Mn Dissolved mg/l	Hg Dissolved mg/l	K Dissolved mg/l	Se Dissolved mg/l
HER069 7/31/90	211	0.17	<0.0002	22.7	0.002

Sample Id	Na Dissolved mg/l	Zn Dissolved mg/l	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l
HER069 7/31/90	82.6	<0.005	152	152	<0.1	39.

Sample Id	pH unit	Conductance µmho/cm	TDS mg/l	TSS mg/l	NO3 as N mg/l	PO4 as P mg/l
HER069 7/31/90	7.28	3261	3540	67	<0.1	0.2

BARRINGER LABORATORIES INC.

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1455 DEMING WAY SUITE 15
SPARKS, NEVADA 89431
PHONE (702) 358-1158

24-Oct-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

Sample Type: Water

Sample Id	SO4 mg/l	SiO2 Dissolved mg/l	Gross Alpha Dissolved pCi/l	Error 2σ*	Gross Beta Dissolved pCi/l	Error 2σ*
HER069 7/31/90	2250	14.3	1	±18	29	±15

Sample Id	Gross Alpha Total pCi/l	Error 2σ*	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Dissolved pCi/l	Error 2σ*
HER069 7/31/90	14	±20	13	±13	3.1	±0.9

Sample Id	Ra-226 Total pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Dissolved mg/l
HER069 7/31/90	5.2	±1.1	0.0	±0.4	0.9	±0.7	0.0009

Sample Id	U Total mg/l
HER069 7/31/90	0.0042

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24-Oct-90

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Job: 902938E Status: Final

Abbreviations:

Parameters:

Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4 as P	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ra-226	: Radium-226

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Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed: Ellen La Riviere
.....
Ellen La Riviere
Radiochemistry Laboratory Manager

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Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 7/12/90 Date: Receiving By: UPS Via:

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Received: 1. HN03 2. H2SO4 3. none 4. NaOH/ZnoAC
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Cl	1	325.2	1 mg/l	3	Hobbs	8/9
Hg	1	245.1	0.0002 mg/l	1	Anshutz	8/9
pH	1	210.1	0.01 unit	3	Anshutz	8/13
Sp. Cond.	1	12011	0.001 mg/l	3	Anshutz	8/17
F	1	340.2	0.05 mg/l	3	Ryman	8/23
Ba	1	200.7	0.01 mg/l	1	Hidalgo	8/27
Cd	1	200.7	0.005 mg/l	3	Hidalgo	8/27
Ca	1	200.7	0.01 mg/l	1	Hidalgo	8/27
Cr	1	200.7	0.01 mg/l	1	Hidalgo	8/28
Cu	1	200.7	0.01 mg/l	1	Hidalgo	8/29
Fe	1	200.7	0.01 mg/l	1	Hidalgo	8/29
Pb	1	200.7	0.001 mg/l	1	Hidalgo	8/29
Mg	1	200.7	0.01 mg/l	1	Hidalgo	8/29
Mn	1	200.7	0.01 mg/l	1	Hidalgo	8/29
K	1	200.7	0.5 mg/l	1	Hidalgo	8/29
Ag	1	200.7	0.01 mg/l	1	Hidalgo	8/29
Na	1	200.7	0.01 mg/l	1	Hidalgo	8/29

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Job: 902938E Status: Final

CONTROL DATA SHEET (cont'd)

Parameter	Ref	Method	LLD	Preservativ	Analysis	Date(s) of Analysis
Zn	1	200.7	0.005 mg/l	1	Hidalgo	8/29
Se	1	270.2	0.001 mg/l	1	Gilleland	8/29
SiO2	1	---	0.01 mg/l	1	Hidalgo	8/29
As	1	206.2	0.001 mg/l	1	Ryman	8/15
Alk	1	210.1	1 mg/l	3	Anshutz	8/30
NO3	1	353.1	0.1 mg/l	2	Hobbs	8/9
TSS	1	160.2	4 mg/l	3	Anshutz	8/9
PO4	1	365.1	0.1 mg/l	3	Hobbs	8/15
SO4	1	375.3	4 mg/l	3	Joy	8/22
TDS	1	160.1	10 mg/l	3	Joy	8/23
Gr. Alpha	4	900.0	1.0 pCi/l	3	Seidel	8/13-8/16
Gr. Beta	4	900.0	2.0 pCi/l	3	Seidel	8/13-8/16
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	8/24-8/28
Th-230	11	---	0.2 pCi/l	3	Ortiz	8/22-8/27
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Tonning	8/28-8/31

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DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HERO69 7/31/90	Cl	39.6	39.6	0
" "	Hg	<.0002	<.0002	0
" "	Sp. Cond.	3261	3261	0
" "	F	1.5	1.5	0
" "	Ba	.01	.01	0
" "	Cd	<.005	.008	(1)
" "	Ca	632	616	1.3
" "	Cr	<.01	<.01	0
" "	Cu	<.01	<.01	0
" "	Fe	12.7	12.2	2.0
" "	Pb	<.02	<.02	0
" "	Mg	211	199	2.9
" "	Mn	.17	.17	0
" "	K	22.7	21.1	2.8
" "	Ag	<.01	<.01	0
" "	Na	82.6	76.7	3.7
" "	Zn	<.005	<.005	0
" "	Se	.002	<.002	(1)
" "	SiO2	14.3	13.9	1.4
" "	As	.001	.001	0
" "	Alk	150.2	153.3	1.0
" "	NO3	<.1	<.1	0
" "	TSS	68	66	1.5
" "	PO4	.19	.19	0
" "	SO4	2260	2230	0.7
" "	TDS	3540	3540	0

(1) sample < 5 times LLD

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QUALITY CONTROL STANDARDS

What known for HER 064???
The Spike Samples were HER 078, 079 & 080

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Cl	52.9	52.1	48.2 - 55.4	0.8	---
Hg	.0086	.0080	.0060 - .0093	3.6	110
F	1.05	1.08	.99 - 1.15	1.4	97
Ba	1.02	1.00	.90 - 1.10	2.0	87
Cd	.218	.200	.180 - .220	9.0	108
Ca	2.04	2.00	1.80 - 2.20	2.0	(2)
Cr. Cond.	.193	.200	.180 - .220	3.5	90
Cu	.202	.200	.180 - .220	1.0	97
Fe	.215	.200	.180 - .220	7.5	(2)
Pb	.211	.200	.180 - .220	5.5	84
Mg	2.14	2.00	1.80 - 2.20	7.0	(2)
Mn	.212	.200	.180 - .220	6.0	92
K	10.2	10.0	9.0 - 11.0	2.0	(2)
Ag	.99	1.00	.90 - 1.10	1.0	92
Na	1.10	1.00	.90 - 1.10	10.0	(2)
Zn	.199	.200	.180 - .220	0.5	86
Se	.010	.009	.006 - .012	11.1	---
SiO2	1.12	1.07	.96 - 1.18	5.0	(2)
As	.103	.100	.080 - .118	1.5	100
NO3	2.02	1.98	1.78 - 2.18	1.0	80
PO4	.51	.50	.46 - .54	1.0	---
SO4	1035.3	1000	900 - 1100	1.8	---
TDS	1460	1479	1331 - 1627	.65	---
Gr. Alpha	197 ± 4	196	176 - 216	0.5	---
Gr. Beta	179 ± 2	173	156 - 190	3.5	---
Ra-226	97 ± 2	101	91 - 111	4.0	---
Th-230	92 ± 3	98	88 - 108	6.1	---
U	33	34	31 - 37	2.9	---

(2) sample > 4 times spiked value

Approved by: Gillian LaRivière

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Received: 18-May-90 15:35

Job: 902490E

Status: Final

Sample Type: Water

Sample	Ag Dissolved mg/l	As Dissolved mg/l	Ba Dissolved mg/l	Ca Dissolved mg/l	Cd Dissolved mg/l	Cr Total mg/l
HER064	<0.01	<0.001	0.01	610	0.007	<0.01

Sample	Cu Dissolved mg/l	F mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l	Mg Dissolved mg/l	Mn Dissolved mg/l
HER064	<0.01	1.4	13.2	<0.02	186	0.18

Sample	Hg Dissolved mg/l	K Dissolved mg/l	Se Dissolved mg/l	Na Dissolved mg/l	Zn Dissolved mg/l	Alkalinity as CaCO3 mg/l
HER064	<0.0002	22.5	<0.001	82.6	<0.005	170

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l	TSS mg/l
HER064	170	<1	41	8.06	3318	3320	93

Sample	NO3 as N mg/l	PO4 as P mg/l	SO4 mg/l	SiO2 Dissolved mg/l	Gross Alpha Error Dissolved pCi/l 2σ*
HER064	<0.1	0.3	1150	13.3	12 ±14

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Received: 18-May-90 15:35

Job: 9014490E

Status: Final

Sample Type: Water

Sample	Gross Beta Error Dissolved pCi/l	2σ*	Gross Alpha Error Total pCi/l	2σ*	Gross Beta Error Total pCi/l	2σ*
HER064	37	±12	44	±18	35	±12

Sample	Ra-226 Dissolved pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*
HER064	1.7	±0.5	2.0	±0.7	0.9	±0.6	1.0	±0.9

Sample	U Dissolved mg/l	U Total mg/l
HER064	0.001	0.008

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Job: 902490E

Status: Final

Abbreviations:

Parameters:

Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4 as P	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ra-226	: Radium-226

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Status: Final

Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed: Ellen La Riviere

Ellen La Riviere
Radiochemistry Laboratory Manager

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Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 3:35 Date: 5/18/90 By: Receiving Via: UPS

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None 4. Zn/Ac
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
pH	1	150.1	.01 unit	3	Ryman	5/22
Cl	1	325.2	1 mg/l	3	Hobbs	5/25
Alk	1	210.1	1 mg/l	3	Ryman	5/22
Hg	1	245.1	.0002 mg/l	1	Gilleland	5/25
Cond.	1	1201	.001 mg/l	3	Ryman	5/31
F	1	340.2	.05 mg/l	3	Hatcher	6/4
Ag	1	200.7	.01 mg/l	1	Hidalgo	6/14
Ba	1	200.7	.01 mg/l	1	Hidalgo	6/14
Ca	1	200.7	.01 mg/l	1	Hidalgo	6/14
Cd	1	200.7	1 mg/l	1	Hidalgo	6/14
Cr	1	200.7	.01 mg/l	1	Hidalgo	6/14
Cu	1	200.7	.01 mg/l	1	Hidalgo	6/14
Fe	1	200.7	.01 mg/l	1	Hidalgo	6/14
Pb	1	200.7	.02 mg/l	1	Hidalgo	6/14
Mg	1	200.7	.01 mg/l	1	Hidalgo	6/14
Mn	1	200.7	.01 mg/l	1	Hidalgo	6/14
K	1	200.7	.5 mg/l	1	Hidalgo	6/14
Na	1	200.7	.01 mg/l	1	Hidalgo	6/14
Zn	1	200.7	.005 mg/l	1	Hidalgo	6/14
As	1	206.2	.001 mg/l	1	Gilleland	6/8
Se	1	270.2	.001 mg/l	1	Gilleland	6/11
SiO2	1	200.7	.01 mg/l	1	Hidalgo	6/14

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Status: Final

QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
NO3	1	353.1	.1 mg/l	2	Hobbs	5/31
TDS	1	160.1	10 mg/l	3	Hatcher	6/1
SO4	1	375.3	4 mg/l	3	Hatcher	6/1
PO4	1	365.1	.1 mg/l	3	Hobbs	6/6
TSS	1	160.2	4 mg/l	3	Hatcher	6/15
Gr. Alpha	4	900.0	1.0 pCi/l	3	Seidel	6/5-6/13
Gr. Beta	4	900.0	2.0 pCi/l	3	Seidel	6/5-6/13
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Kidwell	6/7-6/12
Th-230	11	---	0.2 pCi/l	3	Ortiz	5/31-6/8
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Tonning	6/12-6/15

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER064	Cl	40.2	40.7	1.2
"	Alk	169.7	170.0	.2
"	Hg	<.0002	<.0002	0
"	Cond.	3318	3285	1.0
"	F	1.4	1.5	6.9
"	Ag	<.01	<.01	0
"	Ba	.01	.01	0
"	Ca	610	595	2.4
"	Cd	.007	.007	0
"	Cr	<.01	<.01	0
"	Cu	<.01	<.01	0
"	Fe	13.2	12.9	2.3
"	Pb	<.02	<.02	0
"	Mg	186	181	2.7
"	Mn	.18	.18	0
"	K	22.5	22.4	0.4
"	Na	82.6	79.7	3.5

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Project:

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Job: 902490E

Status: Final

DUPLICATES (Cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER064	Zn	<.005	<.005	0
"	As	<.001	<.001	0
"	Se	<.001	<.001	0
"	SiO2	13.3	13.0	2.3
"	NO3	<.1	<.1	0
"	TDS	3324	3418	2.8
"	SO4	1154	1163	.8
"	PO4	.3	.3	0
"	TSS	93	98	5.2

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Cl	52	52.1	48.2 - 55.4	.2	---
Hg	.006	.005	.004 - .006	17	112
Cond.	1413	1413	-----	0	---
F	1.0	1.0	.89 - 1.09	0	---
Ag	1.02	1.00	.90 - 1.10	2.0	93
Ba	1.08	1.60	.90 - 1.10	8.0	89
Ca	248	250	225 - 275	0.8	---
Cd	.216	.200	.180 - .220	8.0	99
Cr	.209	.200	.180 - .220	4.5	102
Cu	.197	.200	.180 - .220	1.5	88
Fe	.215	.200	.180 - .220	7.5	---
Pb	.219	.200	.180 - .220	9.5	103
Mg	230	250	225 - 275	8.0	---
Mn	.209	.200	.180 - .220	4.5	85
K	9.5	10.0	9.0 - 11.0	5.0	---
Na	262	250	225 - 275	4.8	---
Zn	.205	.200	.180 - .220	2.5	89
As	.095	.100	.080 - .118	5	---

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Received: 18-May-90 15:35

Job: 902490E

Status: Final

QUALITY CONTROL STANDARDS (Cont'd)

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Se	.020	.025	.017 - .028	22	---
SiO2	1.00	1.07	.96 - 1.18	7.0	---
NO3	2.03	1.98	1.78 - 2.18	2.5	---
TDS	1464	1479	1331 - 1627	1.0	---
SO4	1046	1000	900 - 1100	4.5	---
PO4	.54	.50	.46 - .54	7.7	---
Gr. Alpha	190 ± 4	196	176 - 216	3.1	---
Gr. Beta	184 ± 2	173	156 - 190	6.4	---
Ra-226	109 ± 3	101	91 - 111	1.8	---
Th-230	96 ± 3	98	88 - 108	2.0	---
U	34	34	31 - 37	0	---

Approved by: Ellen LaRuine

BARRINGER LABORATORIES INC.

15000 W 6TH AVE SUITE 300
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PHONE (303) 277 1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

17-May-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Page: 1
Copy: 3 of 3
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Project:

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Received: 2-Apr-90 16:37

Job: 902181E

Status: Final

Sample	Alkalinity as CaCO3 mg/l	As Dissolved mg/l	Ba Dissolved mg/l	HCO3 as CaCO3 mg/l	Cd Dissolved mg/l	Ca Dissolved mg/l
HER061	149	0.003	0.03	149	0.009	609

Sample	Cl mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Dissolved mg/l	F mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l
HER061	38	<0.01	3330	0.04	1.4	13.5	0.02

Sample	Mg Dissolved mg/l	Mn Dissolved mg/l	Hg Dissolved mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l
HER061	186	0.22	0.0003	<0.1	6.98	0.2

Sample	K Dissolved mg/l	Se Dissolved mg/l	SiO2 Dissolved mg/l	Ag Dissolved mg/l	Na Dissolved mg/l	TDS mg/l
HER061	24.2	<0.001	13.6	0.01	72.6	3430

Sample	TSS mg/l	SO4 mg/l	Zn Dissolved mg/l	Gross Alpha Error Dissolved pCi/l	2σ*	Gross Beta Error Dissolved pCi/l	2σ*
HER061	59	2290	0.028	23	±18	21	±10

Sample	Gross Alpha Error Total pCi/l	2σ*	Gross Beta Error Total pCi/l	2σ*	Ra-226 Error Dissolved pCi/l	2σ*
HER061	21	±19	40	±11	33	±2

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17-May-90

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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 2-Apr-90 16:37

PO #:

Job: 902181E

Status: Final

Sample	Ra-226 Total pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Dissolved mg/l	U Total mg/l
HER061	36	±2	0.0	±0.3	0.0	±0.4	0.0005	0.0036

How is Ra226 higher than Gross Alpha?
Why is value different from previous page?

Sample	CO3 as CaCO3 mg/l
HER061	<1

BARRINGER LABORATORIES INC.

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17-May-90

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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 2-Apr-90 16:37

PO #:

Job: 902181E

Status: Final

Abbreviations:

Parameters:

As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium
CO3	: Carbonate

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17-May-90

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Page: 4
Copy: 3 of 3
Set : 1

Attn:
Project:

Received: 2-Apr-90 16:37

PO #:

Job: 902181E

Status: Final

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 2-Apr-90 16:37
PO #:

Job: 902181E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 8:30 Date: 4/2/90 By: Receiving Via: UPS

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None 4. NaOH/ZnAc
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Cl	1	325.2	1 mg/l	3	Hobbs	4/5
NO3	1	353.1	.1 mg/l	2	Hobbs	4/4
pH	1	150.1	.01 mg/l	3	Hatcher	4/4
Alk	1	210.1	1 mg/l	3	Hatcher	4/6
F	1	340.2	.05 mg/l	3	Ryman	4/6
PO4	1	365.1	.1 mg/l	3	Hobbs	4/6
Cond.	1	1201	.001 mg/l	3	Ryman	4/23
As	1	206.2	.001 mg/l	1	Gilleland	4/23
Hg	1	245.1	.0002 mg/l	1	Swanson	4/23
Se	1	270.2	.001 mg/l	1	Gilleland	4/24
Cl	1	200.7	1 mg/l	3	Hidalgo	4/30
Ba	1	200.7	.01 mg/l	1	Hidalgo	4/30
Cd	1	200.7	.005 mg/l	1	Hidalgo	4/30
Ca	1	200.7	.01 mg/l	1	Hidalgo	4/30
Cu	1	200.7	.01 mg/l	1	Hidalgo	4/30
Fe	1	200.7	.01 mg/l	1	Hidalgo	4/30
Pb	1	200.7	.02 mg/l	1	Hidalgo	4/30
Mg	1	200.7	.01 mg/l	1	Hidalgo	4/30
Mn	1	200.7	.01 mg/l	1	Hidalgo	4/30
K	1	200.7	.5 mg/l	1	Hidalgo	4/30
Ag	1	200.7	.01 mg/l	1	Hidalgo	4/30
Na	1	200.7	.01 mg/l	1	Hidalgo	4/30

BARRINGER LABORATORIES INC.

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17-May-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 2-Apr-90 16:37

Job: 902181E

Status: Final

QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Zn	1	200.7	.005 mg/l	1	Hidalgo	4/30
TDS	1	160.1	10 mg/l	3	Hatcher	4/5
TSS	1	160.2	4 mg/l	3	Hatcher	4/4
SO4	1	375.3	4 mg/l	3	Hatcher	4/6
SiO2	1	200.7	.01 mg/l	1	Hidalgo	4/30
Gr. Alpha	4	900.0	1.0 pCi/l	3	Kidwell	4/4-4/16
Gr. Beta	4	900.0	2.0 pCi/l	3	Kidwell	4/4-4/16
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	5/7-5/9
Th-230	11	---	0.2 pCi/l	3	Ortiz	4/3-4/5
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Tonning	4/26-5/3

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

16-Feb-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

See page 775 for original(?) HER 044 results

Page: 1
Copy: 1 of 3
Set : 1

HER 044 is from 6/29/89

Received: 8-Feb-90

Attn:
Project: Purchase order :

Job: 901940E Status: Final

ADDITIONAL ANALYSIS

Sample Type: Water

Sample	Gross Alpha Dissolved pCi/l	Error 2σ*	Gross Beta Dissolved pCi/l	Error 2σ*	Ra-226 Dissolved pCi/l	Error 2σ*
HER-044	1	±18	40	±11	0.8	±0.3

Gross alpha for HER 044 is 28 pCi/L

Sample	Th-230 Dissolved pCi/l	Error 2σ*	U Dissolved mg/l
HER-044	0.0	±0.3	0.0018

0.0035 on page 775

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

16-Feb-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

Received: 8-Feb-90
Purchase order :

Job: 901940E

Status: Final

ADDITIONAL ANALYSIS

Abbreviations:

Analyses:

Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Abbreviations:

Units:

pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ
mg/l	: milligrams per liter

Signed: David Lasher

.....

David Lasher
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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16-Feb-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

HER 044 was sampled 6/29/89

Attn:
Project:

Received: 8-Feb-90

Purchase order :

Job: 901940E

Status: Final

ADDITIONAL ANALYSIS

QUALITY CONTROL DATA SHEET

Time Received: Date: 2/8/90 By: G. Reichert Via: In House

Sample Container Type:
Sample Type: water
Preservative When Received: none
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Gr. Alpha	4	900.0	1.0 pCi/l	none	Kidwell	2/7-2/12
Gr. Beta	4	900.0	2.0 pCi/l	none	Kidwell	2/7-2/12
Ra-226	4,7,14	SM-705	0.2 pCi/l	none	Howard	2/9-2/13
Th-230	11	---	0.2 pCi/l	none	Ortiz	2/8-2/12
U	4,9,10,14	ASTMD2907	0.3 µg/l	none	Krizman	2/8-2/9

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER-044	U	0.0017	0.0018	2.9

0.0035 on page 775 for HER 044

BARRINGER LABORATORIES INC.

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16-Feb-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 4
Copy: 1 of 3

Attn:
Project:

Received: 8-Feb-90

Purchase order :

Job: 901940E

Status: Final

ADDITIONAL ANALYSIS

QUALITY CONTROL STANDARDS

?

Parameter	Result	Cert Result	Target Range	Relative Deviation % From Known
This is a different Gross Alpha than on page 758				
Gr. Alpha	197 ± 5	198	178 - 218	0.5
Gr. Beta	182 ± 2	173	156 - 190	5.2
Ra-226	114 ± 3	104	94 - 114	9.6
Th-230	93 ± 3	99	89 - 109	6.1
U	34	34	32 - 36	0

Approved by: David Larsen

cc: Bill Almas, ENERGY FUELS NUCLEAR

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE. SUITE 300
GOLDEN, COLORADO 80401
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PHONE (702) 358-1158

INVOICE

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Date : 22-Feb-90

Job : 901940E

Invoice: 8194E

Authority: PO #:
Project: Terms: Net 30 Days

Sample Type: Water

Analyses:

1	Gross Alpha-Beta/Dissolved	18.00	$ 18.00
1	Ra-226/Dissolved	30.00	$ 30.00
1	Th-230/Dissolved	29.00	$ 29.00
1	U/Dissolved	15.00	$ 15.00

TOTAL DUE: $ 92.00

Remit to: Barringer Laboratories
15000 W. 6th Ave.
Suite 300
Golden, CO 80401

--- Original ---

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE. SUITE 300
GOLDEN COLORADO 80401
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SPARKS, NEVADA 89431
PHONE: (702) 358-1158

9-Jan-90

See page 775

different date than previous 5 pages

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Page: 1
Copy: 1 of 2
Set : 1

Received 12/15/89

Authority:
Project :

Purchase order :

Job: 663E Status: Final

ADDITIONAL ANALYSES

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Specific Conductance µmho/cm	F mg/l
HER 044	91.8	<1	549	43	<0.01	3230	1.1

Sample	Mg Total mg/l	pH unit	PO4 as P Total mg/l	K Total mg/l	SiO2 mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l
HER 044	176	7.82	0.1	27.2	11.1	80.5	3350	2220

HER 044 is from 6/29/89

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

9-Jan-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 633E Status: Final

ADDITIONAL ANALYSES

Abbreviations:

Analyses:

HCO3	: Bicarbonate
CO3	: Carbonate
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
F	: Fluoride
Mg	: Magnesium
PO4 as P	: Phosphate
K	: Potassium
SiO2	: Silica
Na	: Sodium
TDS	: Total Dissolved Solids
SO4	: Sulfate

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter @ 25C

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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1455 DEMING WAY, SUITE 15
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9-Jan-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 633E

Status: Final

ADDITIONAL ANALYSES

QUALITY CONTROL DATA SHEET

Time Received: Date: 12/15/89 By: T.Moncrief Via:

Sample Container Type:
Sample Type: water
Preservative When Received: 1.HNO3 2.none
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
PO4	1	365.1	0.1 mg/l	2	Hobbs	12/18
Cl	1	325.2	1 mg/l	2	Hobbs	12/18
Sp.Cond.	1	1201	0.001 mg/l	2	Hencmann	12/18
pH	1	150.1	0.01 unit	2	Acree	12/18
HCO3/CO3	1	210.1	1 mg/l	2	Acree	12/18
SO4	1	375.3	5 mg/l	2	Acree	12/18
Ca	1	200.7	0.01 mg/l	1	Hidalgo	12/18
Cr	1	200.7	0.01 mg/l	1	Hidalgo	12/18
K	1	200.7	0.5 mg/l	1	Hidalgo	12/18
Mg	1	200.7	0.01 mg/l	1	Hidalgo	12/18
Na	1	200.7	0.01 mg/l	1	Hidalgo	12/18
SiO2	1	200.7	0.01 mg/l	1	Hidalgo	12/18
F	1	340.2	0.05 mg/l	2	Acree	12/18
TDS	1	160.1	10 mg/l	2	Acree	12/19

BARRINGER LABORATORIES INC.

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9-Jan-90

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1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 633E

Status: Final

ADDITIONAL ANALYSES

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER 044	PO4	.13	.13	0.0
HER 044	Cl	42.8	42.8	0.0
HER 044	Sp.Cond.	3231.9	3231.9	0.0
HER 044	pH	7.82	7.82	0.0
HER 044	HCO3	91.8	91.8	0.0
HER 044	SO4	2217	2355	6.0
HER 044	Ca	549	540	1.6
HER 044	Cr	<.01	.01	---
HER 044	K	27.2	27.4	0.7
HER 044	Ng	176	172	2.3
HER 044	Na	80.5	79.0	1.9
HER 044	SiO2	11.1	10.9	1.8
HER 044	F	1.08	1.12	3.6

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9-Jan-90

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One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Page: 5
Copy: 1 of 2

Authority:
Project :

Purchase order :

Job: 633E

Status: Final

ADDITIONAL ANALYSES

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
PO4	.49	.50	.46 - .54	2.0	---
Cl	26.22	26.05	24.1 - 27.7	0.7	---
Sp.Cond.	1413	1413	---	0.0	---
SO4	1079	1000	900 - 1100	7.1	---
Ca	2.12	2.00	1.80 - 2.20	6.0	---
Cr	.213	.200	.180 - .220	6.5	104
K	10.2	10.0	9.0 - 11.0	2.0	101
Mg	2.00	2.00	1.80 - 2.20	0.0	93
Na	.85	.86	.76 - .96	1.0	---
SiO2	1.04	1.07	.96 - 1.18	3.0	113
F	.54	.50	.45 - .55	2.7	109
TDS	1470	1479	1331 - 1627	0.6	---

Approved by: _____

BARRINGER LABORATORIES INC.

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 3 of 3
Set : 1

Received: 10/20/89

Authority:
Project :

Purchase order :

Job: 891358E Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	As Total mg/l	Ba Total mg/l	CO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l
HER 051	150	0.022	0.01	<1	<0.005	547	39	0.01

Sample	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER 051	3600	<0.01	1.43	4.71	<0.02	201	0.39

Sample	Hg Total mg/l	NO3 as N mg/l	PO4 as P Total mg/l	K Total mg/l	Se Total mg/l	SiO2 mg/l	Ag Total mg/l	Na Total mg/l
HER 051	<0.0002	<0.1	<0.1	31.6	0.023	9.8	<0.01	102

Sample	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*	Gross Beta Total pCi/l	Error 2σ*
HER 051	3220	2280	0.013	78	±21	54	±16

Sample	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HER 051	0.8	±0.3	0.0	±0.4	0.0064

BARRINGER LABORATORIES INC.

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

Abbreviations:

Analyses:

HCO3	: Bicarbonate
As	: Arsenic
Ba	: Barium
CO3	: Carbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
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PHONE: (303) 277 1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 3
Copy: 3 of 3
Set : 1

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....
David Lasher
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: Date: 10/20/89 By: T.Moncrief Via: Hand Deliv.

Sample Container Type: small cube, large cube, glass bottle
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH/Zn acetate
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
HCO3	1	210.1	1 mg/l	3	Swanson	11/8
As	1	206.2	0.001 mg/l	1	Gilleland	10/31
Ba	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Cd	1	200.7	0.005 mg/l	1	Hidalgo	11/14
Ca	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Cl	1	325.2	1 mg/l	3	Hobbs	10/25
Cr	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/30
Cu	1	200.7	0.01 mg/l	1	Hidalgo	11/14
F	1	340.2	0.05 mg/l	3	Acree	10/31
Fe	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Pb	1	200.7	0.02 mg/l	1	Hidalgo	11/14
Mg	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Mn	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Hg	1	245.1	0.0002 mg/l	1	Swanson	10/26
NO3	1	353.1	0.1 mg/l	2	Hobbs	10/24
PO4	1	365.1	0.1 mg/l	3	Hobbs	11/9
K	1	200.7	0.5 mg/l	1	Hidalgo	11/14
Se	1	270.2	0.001 mg/l	1	Swanson	11/6
SiO2	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Ag	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Na	1	200.7	0.01 mg/l	1	Hidalgo	11/14

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Job: 891358E

Status: Final

TDS	1	160.1	10	mg/l	3	Acree	10/26
SO4	1	375.3	5	mg/l	3	Acree	10/25
Zn	1	200.7	0.005	mg/l	1	Hidalgo	11/14
Gr.Alpha	4	900.0	1.0	pCi/l	3	Seidel	11/27-12/5
Gr.Beta	4	900.0	2.0	pCi/l	3	Seidel	11/27-12/5
Ra-226	4,7,14	SM 705	0.2	pCi/l	3	Howard	11/13-11/16
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/15-11/22
U	4,9,10,14	ASTM D2907	0.3	µg/l	3	Krizman	10/25-10/27

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER 051	HCO3	150.2	149.2	0.6
HER 051	As	.020	.021	5
HER 051	Ba	.01	.01	0.0
HER 051	Cd	<.005	<.005	0.0
HER 051	Cl	39	39	0.0
HER 051	Cr	.01	.01	0.0
HER 051	Sp.Cond.	3601	3601	0.0
HER 051	Cu	<.01	<.01	0.0
HER 051	F	1.43	1.46	2.1
HER 051	Fe	4.71	4.82	2.3
HER 051	Pb	<.02	<.02	0.0
HER 051	Mg	201	206	2.5
HER 051	Mn	.39	.39	0.0
HER 051	Hg	<.0002	<.0002	0.0
HER 051	NO3	<.1	<.1	0.0
HER 051	PO4	<.1	<.1	0.0
HER 051	K	31.6	32.1	1.5
HER 051	Se	.026	.026	0.0
HER 051	SiO2	9.8	10.0	2
HER 051	Ag	<.01	<.01	0.0
HER 051	Na	102	104	2.0
HER 051	Zn	.013	.015	---
HER 051	U	.0064	.0063	0.8

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PHONE: (702) 358-1158

8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
As	.100	.100	.080 - .118	0.0	---
Ba	1.03	.97	.87 - 1.07	6.0	102
Cd	.193	.200	.180 - .220	3.5	102
Ca	2.04	2.00	1.80 - 2.20	2.0	---
Cl	24.7	26.05	24.1 - 27.7	5.3	---
Cr	.197	.200	.180 - .220	1.5	95
Sp.Cond.	1413	1413	---	0.0	---
Cu	.214	.200	.180 - .220	7.0	94
F	.50	.50	.45 - .55	0.0	82
Fe	.213	.200	.180 -.220	6.5	---
Pb	.217	.200	.180 -.220	8.5	103
Mg	2.19	2.00	1.80 - 2.20	9.5	---
Mn	.204	.200	.180 - .220	2.0	105
Hg	.005	.005	.004 - .006	0.0	100
NO3	2.03	1.98	1.78 - 2.18	2.5	72
PO4	.51	.50	.46 - .54	2.0	---
K	10.2	10.0	9.0 - 11.0	2.0	102
Se	.025	.025	.017 - .028	0.0	---
SiO2	1.05	1.07	.96 - 1.18	2	99
Ag	.92	.99	.89 - 1.09	7	90
Na	.94	.86	.76 - .96	8.0	---
TDS	1390	1479	1331 - 1627	6.2	---
SO4	1033	1000	900 - 1100	3.2	---
Zn	.199	.200	.180 - .220	0.5	97
Gr.Alpha	177 ± 4	198	178 - 218	10.6	---
Gr.Beta	163 ± 2	179	161 - 197	8.9	---
Ra-226	104 ± 3	101	96 - 106	3.0	---
Th-230	103 ± 3	99	94 - 104	4.0	---
U	36	34	32 - 36	5.9	--

Approved by: _____

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PHONE: (702) 358-1158

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: L. Casebolt

Client No. Log No. 633 Client PO No.

Sample Type: water

Date Collected: 6/29/89 Date Received: 7/7/89 Date Reported: 8/3/89

RESULTS OF ANALYSIS

Sample Identification	As Total mg/l	Ba Total mg/l	Cd Total mg/l	Cu Total mg/l	Fe Total mg/l	Pb Total mg/l	Mn Total mg/l
HER044	.004	.02	.006	.02	12.0	<.02	.23

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	Se Total mg/l	Ag Total mg/l	Zn Total mg/l
HER044	<.0002	.3	.020	<.01	.077

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER044	28 ± 21	40 ± 11	0.0035

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 633

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 7/7/89 By: Gina Reichert Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Arsenic	1	206.2	1 ug/1	1	G. Gilliland	7/19/89
Selenium	1	270.2	1 ug/1	1	G. Gilleland	7/19/89
Nitrate	1	353.1	0.1 mg/1	2	D. Hobbs	7/20/89
Mercury	1	245.1	0.2 ug/1	1	M. Swanson	7/20/89
Barium	1	200.7	10 ug/1	1	D. Hidalgo	7/20/89
Cadmium	1	200.7	5 ug/1	1	D. Hidalgo	7/20/89
Copper	1	200.7	10 ug/1	1	D. Hidlago	7/20/89
Iron	1	200.7	10 ug/1	1	D. Hidalgo	7/20/89
Lead	1	200.7	2 ug/1	1	D. Hidalgo	7/20/89
Manganese	1	200.7	1 ug/1	1	D. Hidalgo	7/20/89
Silver	1	200.7	10 ug/1	1	D. Hidalgo	7/20/89
Zinc	1	200.7	5 ug/1	1	D. Hidalgo	7/20/89
Alpha-Beta	4		1.0,2.0 pCi/1	3	M. Kidwell	7/19-7/31/89
Uranium	4,14		0.3 ug/1	3	B. Tonning	7/26-7/29/89

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER044	Arsenic	.004	.005	20.0%
HER044	Selenium	.019	.019	0.0%
HER044	Nitrate	.3	.3	0.0%
HER044	Mercury	<.0002	<.0002	0.0%
HER044	Barium	.02	.02	0.0%

Approved by _____

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Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 633

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER044	Cadmium	.006	<.005	---
HER044	Copper	.02	.02	0.0%
HER044	Iron	12.0	11.9	0.8%
HER044	Lead	<.02	<.02	0.0%
HER044	Manganese	.23	.23	0.0%
HER044	Silver	<.01	<.01	0.0%
HER044	Zinc	.077	.074	3.9%
HER044	Gross Alpha	13 ± 19	42 ± 23	54.0%
HER044	Gross Beta	39 ± 11	42 ± 11	3.7%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Target Range	Relative Deviation From Known	Spike % Recovery
Arsenic	.062	.062	.048 - .073	0.0%	100
Selenium	.009	.009	.006 - .012	0.0%	---
Nitrate	2.08	1.98	1.78 - 2.18	4.9%	101
Mercury	.005	.005	.004 - .006	0.0%	100
Barium	.96	.97	.87 - 1.07	1.0%	97
Cadmium	.212	.200	.180 - .220	6.0%	98
Copper	.205	.200	.180 - .220	2.5%	104
Iron	.219	.200	.180 - .220	9.5%	---
Lead	.181	.200	.180 - .220	9.5%	97
Manganese	.207	.200	.180 - .220	3.5%	106
Silver	.90	.99	.89 - 1.09	9.0%	90
Zinc	.203	.200	.180 - .220	1.5%	115
Gross Alpha	216 ± 4	198	178 - 218	9.1%	---
Gross Beta	175 ± 2	179	161 - 197	2.2%	---
Uranium	33	34	32 - 36	2.9%	---

Approved by Barbara Copp

BARRINGER LABORATORIES INC.

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PHONE: (303) 277 1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 344 Client PO No.

Sample Type: water

Date Collected: 5/31/89 Date Received: 6/2/89 Date Reported: 7/21/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HER041	159	159	<1	.006	<.01

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance umhos/cm	Cu Total mg/l
HER041	.005	546	39.6	.01	3200	.02

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	NO_3 as N mg/l
HER041	1.26	9.85	<.02	187	.17	.0002	<.1

Approved by D. Fackrell

Barringer Laboratories
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Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

Sample Identification	pH units	PO_4 as P mg/l	K Total mg/l	Se Total mg/l	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l
HER041	7.59	<.1	25.7	.018	12.1	<.01	82.0

Sample Identification	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l	S mg/l	Ra-226 (Total) pCi/liter ±Precision*
HER041	3470	88	2360	.015	<2	1.2 ± 0.4

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER041	140± 20	39 ± 11	0.0 ± 0.5	0.0029

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by D. Parker

Barringer Laboratories
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Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET

Time Received: 9:30 Date: 6/2/89 By: Gina Reichert Via: Fed. Express

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Nitrate	1	353.1	0.1 mg/1	2	D. Hobbs	6/6/89
Chloride	1	325.2	0.2 mg/1	3	D. Hobbs	6/7/89
Phosphate	1	365.1	0.01 mg/1	3	D. Hobbs	6/12/89
Mercury	1	245.1	0.2 ug/1	1	M. Swanson	6/15/89
Barium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Cadmium	1	200.7	5 ug/1	1	D. Hidalgo	6/19/89
Calcium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Chromium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Copper	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Iron	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Lead	1	200.7	2 ug/1	1	D. Hidalgo	6/19/89
Magnesium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Manganese	1	200.7	1 ug/1	1	D. Hidalgo	6/19/89
Potassium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Silica	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Selenium	1	270.2	1 ug/1	1	G. Gilleland	6/23/89
Conductance	1	120.1	0.1 umhos/cm	3	A. Knudson	6/26/89
Alkalinity	1	210.1	0.5 mg/1	3	M. Swanson	6/26/89
Arsenic	1	206.2	1 ug/1	1	G. Gilleland	6/27/89
pH	1	150.1	0.01 units	3	A. Knudson	6/28/89
Fluoride	1	340.2	0.1 mg/1	3	A. Knudson	6/29/89
Silver	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Sodium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Zinc	1	200.7	5 ug/1	1	D. Hidalgo	6/19/89
TSS	1	160.2	4 mg/1	3	A. Knudson	6/26/89
TDS	1	160.1	10 mg/1	3	A. Knudson	6/26/89
Sulfate	1	375.3	0.1 mg/1	3	A. Knudson	6/26/89

Approved by D. Parker

BARRINGER LABORATORIES INC.

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PHONE: (303) 277-1687

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SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Engery Fuels Nuclear, Inc.
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 9382 Client PO No.

Sample Type: water

Date Collected: 12/21-27/88 Date Received: 1/9/89 Date Reported: 1/30/89

Supposed to be received within 48 hours

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l
HR032	157	157	<1	.1

Sample Identification	As Total mg/l	Ba Total mg/l	B mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l
HR032 well	.006	.04	.16	<.005	533	40.1

Approved by _____

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Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

Sample Identification	Cr Total mg/l	Conductance umho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l
HR032	.01	3440	.04	1.41	7.33

Sample Identification	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l
HR032	<.02	177	.10	<.0002	.01

Approved by _____

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South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LOGN: 9382

Sample Identification	NO_3 as N mg/l	PO_4 Total mg/l	pH units	K Total mg/l	Se Total mg/l
HR032	<1.0	<.1	7.40	21.6	.012

Sample Identification	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	TSS mg/l	SO_4 mg/l
HR032	12.6	<.01	73.6	3430	9	2220

Approved by _____

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Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

Sample Identification	SO_3 mg/l	Zn Total mg/l	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*
HR032	<5	.136	12 ± 18	30 ± 10

Sample Identification	Ra-226 (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HR032	2.1 ± 0.5	0.6 ± 0.6	0.0024

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2 σ

Approved by Susan K Barbey

BARRINGER LABORATORIES INC.

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GOLDEN, COLORADO 80401
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1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 356-1160

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 8851 Client PO No.

Sample Type: water

Date Collected: Date Received: 9/29/88 Date Reported: 11/15/88

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l	As Total mg/l
HR025 (Hermit Mine)	157	157	<1	<0.1	0.020

Sample Identification	Ba Total mg/l	B Total mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l
HR025 (Hermit Mine)	0.04	0.38	<0.005	494	42.3	0.13

Sample Identification	Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HR025 (Hermit Mine)	3340	0.02	1.32	6.21	<0.02	169

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(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 8851

Sample Identification	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO_3 as N mg/l	pH units	PO_4 as P mg/l
HR025 (Hermit Mine)	0.09	0.0003	0.05	<0.1	7.20	<0.1

Sample Identification	K Total mg/l	Se Total mg/l	SiO_2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l
HR025 (Hermit Mine)	19.4	0.037	11.0	0.02	69.5	3430

Sample Identification	TSS mg/l	SO_4 mg/l	Zn Total mg/l	Sulfite Total mg/l
HR025 (Hermit Mine)	14	2080	0.070	<2

Approved by: M 3.1

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 8851

Sample Identification	Gross Alpha[1] (Total) pCi/liter ±Precision*	Gross Beta[1] (Total) pCi/liter ±Precision*	Ra-226 (Total) pCi/liter ±Precision*
HR025 (Hermit Mine)	76 ± 25	38 ± 11	0.4 ± 0.2

Sample Identification	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HR025 (Hermit Mine)	0.4 ± 0.4	0.0022

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

[1] Gross alpha & gross beta results are based on Thorium-230 and Strontium-90 calibration standards respectively.

BARRINGER LABORATORIES INC.

15000 W 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1466 DEMING WAY, SUITE 16
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
Suite 2500
1200-17th Street
Denver, CO 80202

ATTN: Bill Almas

Client No. | Log No. 8386 Client PO No.

Sample Type: water

Date Collected: Date Received: 7/13/88 Date Reported: 8/17/88

INORGANIC FINAL
RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HR019	155	155	<1	0.015	0.02

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance µmho/cm	Cu Total mg/l
HR019	0.025	577	41	0.15	3210	0.02

Approved by

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15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HR019	1.39	7.48	0.15	192	0.11	0.0011

Sample Identification	NO_3 as N mg/l	PO_4 mg/l	K Total mg/l	Se Total mg/l	SiO_2 Total mg/l	Ag Total mg/l
HR019	<0.1	<0.01	24.4	0.006	12.8	0.02

Approved by

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15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386 |

Sample Identification	Na Total mg/l	TDS mg/l	SO_4 mg/l	Zn Total mg/l
HR019	78.8	3450	2240	0.118

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1455 DEMING WAY SUITE 18
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

Client No. | Log No. 8386 Client PO No.

Sample Type: water

Date Collected: Date Received: 7/13/88 Date Reported: 8/10/88

RADIOCHEMISTRY FINAL
RESULTS OF ANALYSIS **

Sample Identification	Gross Alpha Total pCi/l ±Precision*	Gross Beta Total pCi/l ±Precision*	Ra-226 Total pCi/l ±Precision*
HR019	0 ± 16	27 ± 10	2.6 ± 0.6

Sample Identification	Th-230 Total pCi/l ±Precision*	U Total mg/l
HR019	0.7 ± 0.7	0.0025

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ
** Inorganic results to follow at a later date

Approved by W. Parker

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
One Tabor Center
Suite 2500
1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

LGN: 8386

QUALITY CONTROL DATA SHEET

Time Received: Date: 7/13/88 By: Gina Reichert Via: Federal Expres

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received 4. Zn Acetate

Additional Lab Preparation: none

Parameter	Reference	LLD	Preservative	Analyst	Date(s) of Analysis
Alpha-Beta	4	1.0,2.0 pCi/l	3	Ortiz & Kidwell	7/14-7/21/88
Radium 226	4,7	0.2 pCi/l	3	Howard, Goodale, Kidwell & Garcia	7/26-7/29/88
Thorium 230	11	0.2 pCi/l	3	Ortiz & Taylor	7/15-7/28/88
Uranium	9,10	0.2 pCi/l	3	B. Tonning	7/22-7/25/88

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Gross Alpha	193 ± 4	198	178 - 218	2.6%	---
Gross Beta	178 ± 2	175	157 - 193	1.7%	---
Radium 226	109 ± 3	101	96 - 106	8.0%	---
Thorium 230	100 ± 3	99	94 - 104	1.0%	---
Uranium	34	34	32 - 36	0.0%	101

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PHONE (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE (702) 358-1158

Energy Fules Nuclear
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

Client No. Log No. 8106 Client PO No.

Sample Type: water

Date Collected: 4/28-4/29/88 Date Received: 5/2/88 Date Reported: 6/28/88

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l	As Total mg/l
HR012	159	159	<1	<0.1	0.013

Sample Identification	Ba Total mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance µmho/cm
HR012	0.01	<0.005	585	43	0.10	3430

Sample Identification	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HR012	0.01	1.47	4.03	<0.02	183	0.06

Approved by _____

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PHONE (303) 277-1687

1455 DEMING WAY, SUITE 18
SPARKS, NEVADA 89431
PHONE (702) 358-1158

Energy Fuels Nuclear
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	pH units	PO_4 mg/l	K Total mg/l	Se Total mg/l
HR012	0.0011	0.7	8.02	<0.1	25.3	0.009

Sample Identification	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l
HR012	13.6	0.01	70.1	3500	18	2230	<0.005

Sample Identification	Gross Alpha Total pCi/l ±Precision*	Gross Beta Total pCi/l ±Precision*	Pb-210 Total pCi/l ±Precision*
HR012	0 ± 19	31 ± 12	0.5 ± 0.9

Not possible

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by

BARRINGER LABORATORIES INC.

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GOLDEN, COLORADO 80401
PHONE (303) 277 1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358 1158

Energy Fuels
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN:Rich Munson

LGN: 8106

Sample Identification	Po-210 Total pCi/l ±Precision*	Ra-226 Total pCi/l ±Precision*	Ra-228 Total pCi/l ±Precision*
HR012	0.8 ± 0.5	3.5 ± 0.7	0.0 ± 0.7

Sample Identification	Th-230 Total pCi/l ±Precision*	U Total mg/l
HR012	0.0 ± 0.3	0.0025

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

BARRINGER LABORATORIES INC.

15000 W 6TH AVE SUITE 300
GOLDEN, COLORADO 80401
PHONE (303) 277-1687

1455 DEMING WAY SUITE 15
SPARKS, NEVADA 89431
PHONE (702) 358-1158

Energy Fuels Nuclear
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET

Time Received: Date: 5/2/88 By: Gina Reichert Via: Airplane

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Fluoride	1	340.2	5 mg/l	3	A. Knudson	5/16/88
Conductance	1	120.0	0.1 mhos/cm	3	P. Huebner	5/16/88
Chloride	1	325.3	0.2 mg/l	3	D. Hobbs	5/16/88
Selenium	1	270.2	2 µg/l	1	T. Carr	5/13/88
Phosphate	1	365.1	0.01 mg/l	3	D. Hobbs	5/17/88
pH	1	150.1	0.01 units	3	P. Huebner	5/17/88
Alkalinity	1	310.1	0.5 mg/l	3	P. Huebner	5/17/88
Barium	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Cadmium	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Calcium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Chromium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Copper	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Iron	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Lead	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Magnesium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Manganese	1	200.7	3 µg/l	1	J. Hageman	5/18/88
Potassium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Ammonia	1	350.1	0.1 mg/l	3	D. Hobbs	5/3/88
Mercury	1	245.1	0.2 µg/l	1	G. Gilleland	5/12/88
Arsenic	1	206.2	1 µg/l	1	T. Carr	5/23/88
Silica	1	200.7	10 µg/l	1	J. Hageman	5/23/88
Silver	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Sodium	1	200.7	0.01 µg/l	1	J. Hageman	5/18/88
Zinc	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Total Suspended Solids	1	160.2	4 mg/l	3	R. Lovell	5/17/88

Approved by

BARRINGER LABORATORIES INC.

15000 W 6TH AVE SUITE 300
GOLDEN COLORADO 80401
PHONE (303) 277 1687

1455 DEMING WAY SUITE 15
SPARKS NEVADA 89431
PHONE (702) 358 1158

Energy Fuels Nuclear
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Total Dissolved Solids	1	160.1	10 mg/l	3	R. Lovell	5/19/88
Sulfate	1	375.3	0.1 mg/l	3	R. Lovell	5/19/88
Alpha-Beta	4		1.0,2.0 pCi/l	3	J. Ortiz	5/13-5/23/88
Lead 210	5		1.0 pCi/l	3	M. Kidwell	5/9-5/25/88
Polonium 210	6		1.0 pCi/l	3	J. Ortiz	5/11-5/12/88
Radium 226	4,7		0.2 pCi/l	3	M. Howard	5/9-5/18/88
Radium 228	12,13,14		0.9 pCi/l	3	K. Goodale	5/17-5/27/88
Thorium 230	11		0.2 pCi/l	3	Taylor & Ortiz	5/11-5/16/88
Uranium	9,10		0.2 pCi/l	3	B. Tonning	5/10-5/12/88

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HR012	Fluoride	1.49	1.49	3.4%
HR012	Conductance	3370	3480	3.2%
PN011	Chloride	16	16	0.0%
HR012	Selenium	0.009	0.008	11.0%
PN011	Phosphate	<0.1	<0.1	0.0%
HR012	pH	7.99	8.04	0.6%
HR012	Alkalinity	159	159	0.0%
PN011	Ammonia	<0.1	<0.1	0.0%
HR012	Silver	<0.01	<0.01	0.0%
HR012	Sodium	0.23	0.24	4.3%
HR012	Zinc	0.011	0.011	0.0%
HR012	Total Dissolved Solids	3510	3500	0.4%
HR012	Total Suspended Solids	17	19	11.0%
HR012	Sulfate	2230	2230	0.0%

Approved by _____

BARRINGER LABORATORIES INC.

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GOLDEN, COLORADO 80401
PHONE (303) 277 1687

1455 DEMING WAY SUITE 15
SPARKS, NEVADA 89431
PHONE (702) 358 1158

Energy Fuels Nuclear
One Tabor Center
1200 - 17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Fluoride	0.51	0.50	0.45 - 0.55	2.0%	102
Chloride	26.5	25.85	22.3 - 28.7	2.4%	98
Selenium	0.009	0.009	0.006 - 0.012	0.0%	104
Phosphate	0.47	0.50	0.46 - 0.54	6.2%	---
Barium	0.98	0.97	0.82 - 1.12	1.0%	97
Cadmium	0.098	0.094	0.080 - 0.108	4.0%	103
Calcium	250	250	214 - 288	0.0%	101
Chromium	0.100	0.103	0.088 - 0.118	3.0%	103
Copper	0.105	0.103	0.088 - 0.118	2.0%	102
Iron	0.096	0.102	0.087 - 0.117	6.0%	110
Lead	0.106	0.101	0.086 - 0.116	5.0%	105
Magensium	0.103	0.100	0.085 - 0.115	3.0%	97
Manganese	0.104	10.02	0.087 - 0.117	2.0%	105
Potassium	9.84	10.0	8.5 - 11.5	1.6%	103
Ammonia	2.00	1.98	1.78 - 2.18	1.0%	97
Merucry	0.005	0.005	0.003 - 0.006	0.0%	75
Arsenic	0.099	0.100	0.080 - 0.118	1.0%	80
Silica	1.20	1.07	0.91 - 1.23	13.0%	119
Silver	0.97	0.99	0.84 - 1.14	2.0%	98
Sodium	0.80	0.86	0.73 - 0.99	6.0%	92
Zinc	0.106	0.101	0.086 - 0.116	5.0%	114
Total Dissolved Solids	1479	1479	1331 - 1627	0.0%	---
Sulfate	1030	1000	900 - 1100	3.0%	---
Gross Alpha	198 ± 6	198	178 - 218	0.0%	---
Gross Beta	108 ± 2	104	94 - 114	3.7%	---
Lead 210	112 ± 1	112	106 - 118	0.0%	---
Polonium 210	109	112	106 - 118	2.7%	---
Radium 226	104 ± 3	101	96 - 106	3.0%	---
Radium 228	40 ± 2	40	38 - 42	0.0%	---
Thorium 230	97 ± 3	99	94 - 104	2.1%	---
Uranium	32	34	32 - 36	5.9%	---

Approved by _____

File Divider Page

IUC
INTERNATIONAL
URANIUM (USA)
CORPORATION

100299

WATER PERMITS
FEB 0 1 1999
RECEIVED

H.C. 64 • Box 153 • 2555 No. Highway 89A • Fredonia, AZ 86022 • 520 643 7321 (phone) • 520 643 7328 (fax)

January 29, 1999

VIA UPS
Mr. Craig DeWalt, REM
Arizona Department of Environmental Quality
3033 North Central Avenue, M0401A
Phoenix, Arizona 85012

Re: Hermit Mine - Clean Closure - Additional Information Requests

Dear Craig,

Pursuant to our telephone conversation on January 14, 1999, enclosed please find the additional information you requested in regard to the Hermit Mine Clean Closure report.

International Uranium (USA) Corporation is submitting two copies of the additional information you requested in order to facilitate expeditious review of the responses and supporting documentation. After reviewing the enclosed data should you have any questions or require additional information please feel free to call Mr. Roger Smith, General Manager of Mining Operations or me at 520-643-7321.

Very truly yours,

Donn M. Pillmore

Donn M. Pillmore
Project Manager

Enclosures

cc: Dennis L. Turner/ADEQ
Jayanta Das/ADEQ
R. B. Smith

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

WATER PERMITS
FEB 0 1 1999
RECEIVED

HERMIT MINE CLOSURE
ADDITIONAL INFORMATION REQUESTS PER PHONE CALL FROM CRAIG DEWALT W/ADEQ, JANUARY 14, 1999

1) Discrepancy between well registration number cited in the Notice of Disposal documentation (reg. # 55-517832) and the well registration number on the monitoring well (55-518877). Please clarify.

RESPONSE:

Energy Fuels Nuclear, Inc. selected a drilling contractor and commenced drilling a water supply well on July 10, 1987. The registration number of this well was 55-517832. The bore hole was drift surveyed at a depth of 975 feet, which revealed the bore hole had drifted excessively. Because the drilling contractor specified a maximum deviation of 4 degrees, which was exceeded, the contractor elected to abandon the job. The bore hole was abandoned and reclaimed on August 19, 1987 in compliance with state regulations and all necessary forms and notices filed with the State.

Drilling on the water well (Arizona Registration No. 55-518877) commenced on August 27, 1987, after receipt of the necessary drilling permits from the Arizona Department of Water Resources. This well was completed to a total depth of 3,030 feet on December 23, 1987. The hole bottomed in the Redwall Limestone Formation.

2) ADEQ needs a copy of the well completion/construction detail. Wants to know the TD of the well, where the aquifer was intersected, and where the pump is positioned. Also we need to verify the elevation of the bottom of the mine.

RESPONSE

The well was drilled to a total depth of 3,030 feet and bottomed in the Redwall Limestone Formation. Water was encountered at a depth of 2,855 feet and the pump was set at a depth of 1,917 feet. Dimensions and depths of the well and casing strings are presented as follows:

Hole Size and Depth	Casing Size and Length
12 1/4"- Surface to 20 feet	10", 1/4" wall, 17 feet
11" - 20 to 980 feet	8 5/8", 24 lb., 970 feet
7 7/8" - 980 to 1,810 feet	5 1/2", 14 lb., 1,798 feet
6 1/4" - 1,810 to 2,020 feet	Uncased hole from 1,798 feet to
4 3/4" - 2,020 to 3,030 feet	3,030 feet, TD

A casing grout job was performed on the 5 1/2" casing by Halliburton Co. of Farmington, NM on November 4, 1987. An expandable packer shoe was installed at the bottom of the 5 1/2" casing to protect the open hole below the 1,798 foot depth.

3) Latitude and Longitude of the monitor well.

RESPONSE:

Latitude: 36°41'21" N
Longitude: 112°45'04" W

4) A copy of the actual lab reports for all of the monitoring data, from mine closure in 1990 to present, that have been reported to the ADEQ on their data sheets.

RESPONSE:

A copy of the actual lab reports for all of the monitoring data from mine closure in 1990 to present are enclosed. Quarterly monitoring was being conducted between the 4th quarter 1990 (sample HER073) and the 2nd quarter in 1993 (sample HER137), for a total of 11 laboratory analyses. Bi-annual monitoring commenced in 1993 (sample HER148), for a total of 11 laboratory analyses.

5) A written explanation why the GWPP states that there will be a single pond with 12.6 acre feet and in fact we constructed 2 ponds (6.5 & 6.8 acre feet) and how this satisfied the requirements to be able to handle a 500 year storm event.

- "As Built" drawings of the pond for the file
- Documentation on pond construction if available
- Written statement that the ponds were inspected on a weekly basis, and that when the pond liner was salvaged what condition it was in and whether or not it was reused on another project

RESPONSE:

Two ponds were constructed at the Hermit Mine with a total capacity of 13.3 acre feet. The pond was originally going to be constructed as a single 12.6 acre feet pond, but to facilitate mining operations the pond was constructed as two cells joined together with a spillway. The resultant facility was two cells, a 6.5 acre feet cell and a 6.8 acre feet cell. During life of the mining operation, it was only necessary to use the 6.5 acre feet cell, the 6.8 acre feet cell was never required for water strorage.

An "as built" drawing of the pond can not be located, although, an "in-house" memorandum discussing the Hermit Pond Liner Installation is enclosed for your review. The two celled pond

was inspected on a weekly basis to check the pond liner and verify there were no rips or damage which could cause leakage. The pond liner was salvage during reclamation activities for future use on other mining operations.

6) Prepare and submit a summation of the monitor well water analysis from mine shut down in 1990 to present. Include a statement to the effect that since there have not been any significant fluctuations in the monitoring results, that monitoring at the Hermit mine should be terminated.

RESPONSE:

A summary of all of the monitor well water analysis, from mine shut down in 1990 to present, has been prepared and is attached herewith. As noted in 4) above, quarterly monitoring was being conducted between the 4th quarter 1990 (sample HER073) and the 2nd quarter in 1993 (sample HER137), for a total of 11 laboratory analyses. Bi-annual monitoring commenced in 1993 (sample HER148), for a total of 11 laboratory analyses.

7) There was a letter, written March 8, 1995 by Roger Smith, that states steps will be taken to resolve the apparent exceedences from analysis performed on water samples from the monitoring well. Was there any follow-up to this letter?

RESPONSE:

No follow up letters or data can be located, however, it was determined at the time the malfunctioning pump was pulled from the well, that water samples were contaminated from heavy build up of scale material accumulated on the inside and outside of the pump discharge column. Also, a condition of natural occurring electrolysis at the pump elevation took place, significantly replacing the metal pump stator and column pipe with other minerals and metals. This condition clearly contributed to the minor exceedences detected during on going analysis of water from the monitor well.

HERMIT MINE
WATER WELL MONITORING DATA
4th Quarter 1990 to Present

Quarterly Sampling

Parameters	HER073 Collected 10/24/90	HER094 Collected 3/28/91	HER100 Collected 4/30/91	HER112 Collected 9/20/91	HER114 Collected 12/19/91	HER120 Collected 3/26/92	HER122 Collected 6/26/92	HER126 Collected 9/22/92
	4th-1990	1st-1991	2nd-1991	3rd-1991	4th-1991	1st-1992	2nd-1992	3rd-1992
Silver	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.002	0.002	<0.001	0.006	<0.001	0.002	0.003	<0.001
Barium	0.01	0.01	0.01	0.02	0.01	0.04	<0.01	0.01
Calcium	525	513	579	658	571	566	587	524
Cadmium	<0.005	<0.005	0.009	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	<0.01	<0.01	0.01	0.02	0.03	0.03	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	0.01	0.02	0.03	<0.01	<0.01
Iron	9.47	6.41	7.07	9.3	6.61	6.10	5.64	5.40
Lead	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Magnesium	177	161	191	218	184	191	199	204
Manganese	0.12	0.09	0.09	0.12	0.09	0.1	0.07	0.06
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002
Potassium	20.1	20.7	21.7	25.0	20.2	21.3	21.4	21.7
Selenium	<0.002	<0.002	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium	78.1	68.6	75.1	91.0	73.3	75.5	78.6	79.1
Zinc	0.111	<0.005	<0.005	<0.005	0.005	0.052	0.176	0.038
Fluoride	1.5	1.6	1.5	<0.1	0.5	0.9	1.6	3.1
Alkalinity	161	154	162	177	173	168	159	160
HCO3	161	154	162	177	173	168	159	160
CO3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride	40	41	40	72	38	40.0	35.0	41.0
pH	7.38	6.84	7.56	7.09	6.95	7.89	7.37	6.98
Specific Conductance (a)	3470	2440	2580	3140	4140	3060	1500	3700
TDS	3380	3250	3360	3280	3760	3410	3410	3330
NO3 as N	<0.1	<0.1	<0.1	0.2	0.9	<0.1	0.2	<0.1
Phosphate	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate	1830	2290	2270	1860	2290	2200	2100	2280
Silica	13.0	12.6	12.7	14.0	13.4	17.0	5.4	6.13
Gross Alpha (b)	58±26	71±31	10±19	27±21	12±18	9±20	24±16	24±22
Gross Beta (b)	48±14	27±15	15±14	24±13	37±13	44±15	32±14	34±12
Ra 226 (b)	3.2±0.6	2.4±0.5	3.5±0.7	2.8±0.6	1.9±0.5	8.9±1.7	3.1±0.9	10±2
Th 230 (b)	0.0±0.5	0.0±0.4	0.0±0.5	0.0±0.5	0.0±0.5	0.0±0.5	0.0±0.5	0.0±1.0
Uranium	0.0009	0.0027	0.0016	<0.0003	0.0019	0.0008	0.0004	0.0005

LEGEND

Units in mg/l unless noted
(a)units in micro Mhos/cm
(b)units reported in picocuries/l
DL - Detection Limit
BDL - Below Detection Limit
MGL - Maximum Groundwater Limit

HERMIT MINE
WATER WELL MONITORING DATA
4th Quarter 1990 to Present

	Quarterly Sampling			Bi-Annual Sampling			
Parameters	HER129 Collected 12/10/92	HER134 Collected 3/3/93	HER 137 Collected 6/16/93	HER148 Collected 2/16/93	HER150 Collected 3/03/94	HER167 Collected 12/09/94	HER176 Collected 06/21/95
	4th-1992	1st-1993	2nd-1993	2nd-1993	1st-1994	2nd-1994	1st-1995
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	0.003	0.005	<0.001	<0.001	0.002	0.003	<0.003
Barium	0.01	0.01	0.01	0.01	0.01	<0.02	<0.02
Calcium	618	600	652	628	623	660	592
Cadmium	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	4.83	4.62	4.77	4.27	4.24	4.30	4.10
Lead	0.03	<0.02	<0.02	<0.02	<0.02	0.005	0.005
Magnesium	208	200	208	212	201	205	197
Manganese	0.05	0.05	0.06	0.05	0.05	0.055	0.046
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Potassium	23.9	22.8	23.4	24.0	21.1	23.0	22.0
Selenium	0.032	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005
Sodium	84.4	79.7	83.0	86.2	78.7	83.0	79.0
Zinc	<0.005	<0.005	<0.005	<0.005	<0.005	<0.02	<0.02
Fluoride	1.5	2.1	2.8	3.0	2.8	3.2	1.1
Alkalinity	158	152	162	160	163	159	172
HCO3	158	152	162	160	163	159	172
CO3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride	37.0	38.0	37.0	38.0	37.0	39.0	35.0
pH	6.87	6.90	6.93	7.02	7.00	7.06	7.25
Specific Conductance (a)	3520	3040	2030	3330	3434	3270	3420
TDS	3410	2790	3450	3320	3250	3240	3200
NO3 as N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2
Phosphate	<0.1	<0.02	<0.1	<0.1	<0.1	<0.02	<0.05
Sulfate	2130	1960	2280	2200	2290	2240	2180
Silica	6.17	6.23	6.12	6.5	6.3	13.0	13.0
Gross Alpha (b)	46±29	23±22	34±25	51±20	15±13	11±17	53±25
Gross Beta (b)	48±13	27±14	58±26	46±14	21±14	12±12	60±20
Ra 226 (b)	5.8±1.3	9.0±1.5	9.3±2.1	10±2	8.9±1.3	7.4±0.8	10±1
Th 230 (b)	1.6±0.8	0.4±0.6	0.2±0.8	0.4±0.7	0.5±0.7	0.4±0.3	0.6±0.6
Uranium	0.0005	0.0006	0.0022	0.0003	<0.0003	0.0019	0.0007

LEGEND

Units in mg/l unless noted
(a)units in micro Mhos/cm
(b)units reported in picocuries/l
DL - Detection Limit
BDL - Below Detection Limit
MGL - Maximum Groundwat

HERMIT MINE
WATER WELL MONITORING DATA
4th Quarter 1990 to Present

Bi-Annual Sampling

Parameters	HER183 Collected 11/14/95	HER189 Collected 05/15/96	HER192 Collected 07/31/96	HER208 Collected 06/18/97	HER218 Collected 12/30/97	HER223 Collected 06/25/98
	2nd-1995	1st-1996	2nd-1996	1st-1997	2nd-1997	1st-1998
Silver	<0.01	<0.01	<0.01	<0.01	<0.0005	<0.0005
Arsenic	<0.003	<0.003	<0.003	0.005	0.001	0.002
Barium	<0.02	<0.02	<0.02	<0.02	<0.02	0.013
Calcium	652	617	604	585	596	561
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001
Copper	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001
Iron	4.50	4.70	4.00	2.10	2.51	5.91
Lead	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Magnesium	217	208	202	199	194	190
Manganese	0.055	0.046	0.044	0.040	0.050	0.084
Mercury	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002
Potassium	22.0	21.0	22.0	21.0	20.0	20.6
Selenium	<0.005	<0.005	<0.005	<0.005	<0.01	<0.001
Sodium	87.0	76.0	81.0	82.0	75.0	74.2
Zinc	<0.02	<0.02	<0.02	<0.02	0.002	<0.02
Fluoride	1.7	1.6	1.7	1.5	1.5	1.4
Alkalinity	164	165	160	160	166	163
HCO3	164	165	160	160	166	163
CO3	<5.0	<1.0	<1.0	<1.0	<2.0	<2.0
Chloride	36.0	38.0	36.0	37.0	35.0	35.0
pH	7.07	7.84	7.20	7.85	7.00	7.40
Specific Conductance (a)	3410	3380	3370	3100	3250	3350
TDS	3220	3360	3340	3320	3220	3520
NO3 as N	<0.1	<0.1	0.1	<0.01	0.02	0.04
Phosphate	<0.05	<0.02	<0.02	<0.05	<0.005	<0.005
Sulfate	2280	2500	2240	2340	2180	2120
Silica	14.0	14.0	14.0	14.0	13.0	12.5
Gross Alpha (b)	15±17	35±21	18±18	36±26	13±13	9±14
Gross Beta (b)	44±17	30±25	5±31	8±47	32±13	32±12
Ra 226 (b)	7.3±0.8	4.3±0.7	7.5±0.8	9.5±1.2	11.1±1	11.0±.87
Th 230 (b)	0.0±0.1	0.0±0.4	0.0±0.4	0.2±0.4	0.2±0.1	0.46±0.3
Uranium	<0.0003	0.0018	0.0011	<0.0009	0.0007	<0.0005

LEGEND

Units in mg/l unless noted
(a)units in micro Mhos/cm
(b)units reported in picocuries/l
DL - Detection Limit
BDL - Below Detection Limit
MGL - Maximum Groundwat

HERMIT MINE
WATER WELL MONITORING DATA
4th Quarter 1990 to Present

Parameters	HER228 Collected 11/23/98	STATISTICAL SUMMARY		
	2nd-1998	DATA RANGE MIN - MAX	AVERAGE	MGL
Silver	<0.0005	BDL - 0.01	BDL	0.03
Arsenic	0.002	BDL - .006	0.0025	0.024
Barium	0.012	BDL - 0.04	0.0152	0.06
Calcium	552	513 - 660	594	630
Cadmium	<0.0005	BDL - .009	0.0053	0.027
Chromium	<0.001	BDL - 0.03	0.011	0.21
Copper	<0.001	BDL - 0.03	0.01	0.04
Iron	19.3	2.10 - 19.3	5.92	11.21
Lead	<0.001	BDL - 0.03	0.0132	0.16
Magnesium	193	161 - 218	198	199
Manganese	0.341	.010 - .341	0.080	0.19
Mercury	<0.0002	BDL - .0002	BDL	0.002
Potassium	21.0	20.0 - 25.0	21.8	28.7
Selenium	<0.001	BDL - .032	0.004	0.043
Sodium	76.6	68.6 - 91.0	79.3	85.7
Zinc	<0.02	BDL	0.0265	0.189
Fluoride	1.4	0.1 - 3.2	1.7	1.53
Alkalinity	118	118 - 177	160.7	161
HCO3	118	118 - 177	160.7	161
CO3	<2.0	BDL	BDL	0
Chloride	37.0	35.0 - 72.0	39.2	44.0
pH	6.90	6.84 - 7.89	7.20	6.85
Specific Conductance (a)	3200	1500 - 4140	3142	3555
TDS	3290	2790 - 3760	3323	3615
NO3 as N	0.03	BDL - 0.9	0.05	0.8
Phosphate	0.007	BDL - .007	0.065	0
Sulfate	1900	1830 - 2500	2180	2425
Silica	5.7	5.4 - 17.0	10.9	14.3
Gross Alpha (b)	47±19	9±14 - 71±31	29.14	84
Gross Beta (b)	49±13	5±31 - 60±20	33.32	43
Ra 226 (b)	4.8±.87	4.3±0.7 - 11.1±1	6.9	4.4
Th 230 (b)	0.14±0.3	0.0±0.1 - 1.6±0.8	0.23	1.0
Uranium	0.001	BDL - .0027	0.001	0.003

LEGEND

Units in mg/l unless noted
(a)units in micro Mhos/cm
(b)units reported in picocuries/l
DL - Detection Limit
BDL - Below Detection Limit
MGL - Maximum Groundwat

MEMORANDUM

TO: Rober A. Hembree, Mine Planning Engineer

FROM: John F. Beesley, Jr. Mine Engineer

SUBJECT: Hermit Pond Liner Installation

DATE: September 3, 1987

Installation of the pond liner at Hermit began August 12, 1987 with preparation of the pond bottom surfaces. The bottom and sides were rolled with a double drum, self-propelled, vibrating compactor. They were then inspected and any protruding rocks and twigs were removed. Preparation of the liner surface took 2 men 2 weeks to complete. Care was taken to ensure a smooth, competent bed for the liner. An anchor trench 1 foot deep and 18 inches wide was also cut during preparation for anchoring the liner.

A high density, chlorosulfonated polyethylene, Hypalon liner, 36 mils thick, was laid down on August 18 and 19. We used 10 workers both days to spread the liner. Four panels, 57.75 feet by 200 feet, were spread for a total of 46,200 square feet of liner. Three field seams, each 200 feet long, were seamed using trichloroethane prewipe and Hypalon to Hypalon bonding cement. Seaming was done under the direct supervision of myself to ensure that procedures were meticulously followed, ie., proper cleaning of surface, application of prewipe, even spreading of glue, liner laying flat with no wrinkles, surfaces pressed together and rolled flat. Seaming was not attempted when temperatures were lower than 75 degrees.

All seams were checked with a 90 psi air lance. All bubbles, leaks and weak spots were patched and rechecked. The maximum depth of the pond is 10 feet, the airlance pressure corresponds to over 200 feet of water so seams are guaranteed to be water tight. All factory seams were also air lanced. As field engineer, I personally airlanced every foot of field seams. All field seams were checked at least three times and some even four times. Confidence that the liner is watertight is very high.

The liner was installed following specifications outlined by the Hypalon manufacturer. We also complied with all other requirements as outlined in the mine plan. Volume of the pond has been calculated and is 6.5 acre feet. Only one side of pond was lined

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1-Feb-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 3
Set : 1

Attn:
Project:

PO #:

Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	CO3 as CaCO3 mg/l	HCO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l
HER073	161	<1	161	40	7.38	3470	3380

Sample	TSS mg/l	NO3 as N mg/l	PO4 as P mg/l	SO4 mg/l	SiO2 mg/l	As Total mg/l	Ba Total mg/l
HER073	<4	<0.1	<0.1	1830	13.0	0.002	0.01

Sample	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l	F mg/l	Fe Total mg/l
HER073	525	<0.005	<0.01	<0.01	1.5	9.47

BARRINGER LABORATORIES INC.
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GOLDEN, COLORADO 80401
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1-Feb-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	K Total mg/l	Ag Total mg/l
HER073	<0.02	177	0.12	<0.0002	20.1	0.01

Sample	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HER073	<0.002	78.1	0.111	58	±26

BARRINGER LABORATORIES INC.
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1-Feb-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Ra-228 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*
HER073	48	±14	3.2	±0.6	1.5	±1.3	0.0	±0.5

Sample	U Total mg/l
HER073	0.0009

BARRINGER LABORATORIES INC.
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RECEIVED

2-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm
HER094	154	154	<1	41	6.84	2440

Sample	TDS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l	Ag Total mg/l
HER094	3250	<0.1	<0.1	2290	12.6	<0.01

Sample	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l
HER094	0.002	0.01	513	<0.005	<0.01	<0.01

Sample	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HER094	1.6	6.41	<0.02	161	0.09	<0.0002

Sample	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ
HER094	20.7	<0.002	68.6	<0.005	71	±31

Sample	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER094	27	±15	2.4	±0.5	0.0	±0.4	0.0027

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

22-May-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Attn:
Project: Hermit Min

Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm
HER100	162	162	<1	40	7.56	2580

Sample	TDS mg/l	TSS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l
HER100	3360	17	<0.1	<0.1	2270	12.7

Sample	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l
HER100	<0.01	<0.001	0.01	579	0.009	0.01

Sample	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER100	<0.01	1.5	7.07	<0.02	191	0.09

Sample	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l
HER100	<0.0002	21.7	<0.001	75.1	<0.005

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ
HER100	10	±19	15	±14	3.5	±0.7

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

22-May-91

Don Pilmor
ENERGY FUELS NUCLEAR
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Fredonia, AZ 86022

Page: 2
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Attn:
Project: Hermit Min

Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

Sample Type: Water

Sample	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER100	0.0	±0.5	0.0016

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Oct-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Attn:
Project:

PO #:

Received: 26-Sep-91 10:42

Job: 911810E

Status: Final

Sample Type: Water

Sample	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l
HER 112	<0.01	0.006	0.02	658	<0.005	0.02

Sample	Cu Total mg/l	F Total mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER 112	0.01	<0.1	9.3	<0.02	218	0.12

Sample	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Alkalinity as CaCO3 mg/l
HER 112	<0.0002	25	<0.002	91	<0.005	177

Sample	pH unit	TDS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 Dissolved mg/l
HER 112	7.09	3280	0.2	<0.1	1860	14

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	Specific Conductance µmho/cm	Gross Alpha Total pCi/l	Error 2σ
HER 112	177	<1	72	3140	27	±21

Sample	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER 112	24	±13	2.8	±0.6	0.0	±0.5	<0.0003 *

* Verified by reanalysis.

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

20-Jan-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Set : 1

Attn: Lawrence Casebolt
Project:

Received: 6-Jan-92 11:29

PO #:

Job: 923028E

Status: Final

Sample Type: Water

Sample	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l
HER 114	<0.01	<0.001	0.01	571	<0.005	0.03

Sample	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER 114	0.02	0.5	6.61	<0.02	184	0.09

Sample	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Alkalinity as CaCO3 mg/l
HER 114	<0.0002	20.2	<0.002	73.3	0.005	173

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Conductance µmho/cm	TDS mg/l
HER 114	173	<1	38	6.95	4140	3760

Sample	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 Total mg/l	Gross Alpha Total pCi/l	Error 2σ
HER 114	0.9	*<1	2290	13.4	12	±18

Sample	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER 114	37	±13	1.9	±0.5	0.0	±0.5	0.0019

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

13-May-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Set : 1

Attn:
Project:

Received: 3-Apr-92 09:18

PO #:

Job: 923806E

Status: Final

Parameter			HER 120 Water
Silver	Total	mg/l	<0.01
Arsenic	Total	mg/l	0.002
Barium	Total	mg/l	0.04
Calcium	Total	mg/l	566
Cadmium	Total	mg/l	<0.005
Chromium	Total	mg/l	0.03
Copper	Total	mg/l	0.03
Fluoride		mg/l	0.9
Iron	Total	mg/l	6.1
Lead	Total	mg/l	<0.02
Magnesium	Total	mg/l	191
Manganese	Total	mg/l	0.10
Mercury	Total	mg/l	<0.0002
Potassium	Total	mg/l	21.3
Selenium	Total	mg/l	<0.002
Sodium	Total	mg/l	75.5
Zinc	Total	mg/l	0.052
Alkalinity	as CaCO3	mg/l	168
HCO3	as CaCO3	mg/l	169
CO3	as CaCO3	mg/l	<1
Chloride		mg/l	40
pH		unit	7.89
Specific	Conductance	µmho/cm	3060
TDS		mg/l	3410
NO3 as N		mg/l	<0.1
Phosphate		mg/l	<0.1
Sulfate		mg/l	2200
Silica	Total	mg/l	17.0

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13-May-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 3-Apr-92 09:18

Job: 923806E

Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ
HER 120	9	±20	44	±15	8.9	±1.7	0.0	±0.5

Sample	U Total mg/l	U Total pCi/l(1)
HER 120	0.0008	0.5

BARRINGER LABORATORIES INC.
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5-Aug-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
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Attn:
Project: Hermit Mine H2O Well PO #:

Received: 6-Jul-92 09:30

Job: 924506E Status: Final

Sample Type: Water

Sample	Silver Total mg/l	Arsenic Total mg/l	Barium Total mg/l	Calcium Total mg/l	Cadmium Total mg/l	Chromium Total mg/l	Copper Total mg/l
HER122	<0.01	0.003	<0.01	587	<0.005	<0.01	<0.01

Sample	Fluoride Total mg/l	Iron Total mg/l	Lead Total mg/l	Magnesium Total mg/l	Manganese Total mg/l	Mercury Total mg/l
HER122	1.6	5.64	<0.02	199	0.07	<0.0002

Sample	Potassium Total mg/l	Selenium Total mg/l	Sodium Total mg/l	Zinc Total mg/l	Alkalinity as CaCO3 mg/l	CO3 as CaCO3 mg/l
HER122	21.4	<0.002	78.6	0.176	159	<1

Sample	HCO3 as CaCO3 mg/l	Chloride mg/l	pH unit	Conductance µmho/cm	TDS mg/l	NO3 as N mg/l
HER122	159	35	7.37	1500	3410	0.2

Sample	Phosphate mg/l	Sulfate mg/l	SIO mg/l
HER122	<0.1	2100	5.40

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5-Aug-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 2
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Attn:
Project: Hermit Mine H2O Well PO #:

Received: 6-Jul-92 09:30

Job: 924506E Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ
HER122	24	±16	32	±14	3.1	±0.9	0.0	±0.5

Sample	U Total mg/l	U Total pCi/l(1)
HER122	0.0004	0.3

BARRINGER LABORATORIES, INC.
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21-Oct-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn: Lawrence Casebolt
Project: Hermit Mine Well PO #:

Received: 30-Sep-92 09:30

Job: 925116E Status: Final

Parameter			HER126 Water
Silver	Total	mg/l	<0.01
Arsenic	Total	mg/l	<0.001
Barium	Total	mg/l	0.01
Calcium	Total	mg/l	524
Cadmium	Total	mg/l	<0.005
Chromium	Total	mg/l	<0.01
Copper	Total	mg/l	<0.01
Fluoride		mg/l	3.1
Iron	Total	mg/l	5.40
Lead	Total	mg/l	<0.02
Magnesium	Total	mg/l	204
Manganese	Total	mg/l	0.06
Mercury	Total	mg/l	0.0002
Potassium	Total	mg/l	21.7
Selenium	Total	mg/l	<0.002
Sodium	Total	mg/l	79.1
Zinc	Total	mg/l	0.038
Alkalinity	as CaCO3	mg/l	160
CO3	as CaCO3	mg/l	<1.0
HCO3	as CaCO3	mg/l	160
Chloride		mg/l	41
pH		unit	6.98
Conductance		µmho/cm	3700
TDS		mg/l	3330
NO3 as N		mg/l	<0.1
Phosphate		mg/l	<0.1
Sulfate		mg/l	2280
Silica	Total	mg/l	6.13

BARRINGER LABORATORIES, INC.
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21-Oct-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn: Lawrence Casebolt
Project: Hermit Mine Well PO #:

Received: 30-Sep-92 09:30

Job: 925116E Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ
HER126	24	±22	34	±12	10	±2

Sample	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER126	0.0	±1.0	0.0068

— See HER127 attached for re-analysis of U

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10-Nov-92

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: R-1
Copy: 1 of 2

Attn: Lawrence Casebolt
Project: Hermit Mine Well PO #:

Received: 6-Nov-92 09:30

Job: 925466E Status: Final

Sample Type: Water

Sample	U Total mg/l
HER127	0.0005

This is a magnitude lower than the precision of the method used

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

BARRINGER LABORATORIES INC.
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18-Jan-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn: Lawrence Casebolt
Project: Hermit Mine Well PO #:

Received: 15-Dec-92 09:30

Job: 925747E Status: Final

Sample Type: Water

Sample	Silver Total mg/l	Arsenic Total mg/l	Barium Total mg/l	Calcium Total mg/l	Cadmium Total mg/l	Chromium Total mg/l	Copper Total mg/l
HER129	<0.01	0.003	0.01	618	<0.005	<0.01	<0.01

Sample	Fluoride mg/l	Iron Total mg/l	Lead Total mg/l	Magnesium Total mg/l	Manganese Total mg/l	Mercury Total mg/l
HER129	1.5	4.83	0.03	208	0.05	<0.0002

Sample	Potassium Total mg/l	Selenium Total mg/l	Sodium Total mg/l	Zinc Total mg/l	Alkalinity as CaCO3 mg/l	CO3 as CaCO3 mg/l
HER129	23.9	0.032	84.4	<0.005	158	<1

Sample	HCO3 as CaCO3 mg/l	Chloride mg/l	pH unit	Conductance µmho/cm	TDS mg/l	NO3 as N mg/l
HER129	158	37	6.87	3520	3410	<0.1

Sample	Phosphate Dissolved mg/l	Sulfate mg/l	Silica Total mg/l
HER129	<0.1	2130	6.17

BARRINGER LABORATORIES INC.
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18-Jan-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn: Lawrence Casebolt
Project: Hermit Mine Well PO #:

Received: 15-Dec-92 09:30

Job: 925747E Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ
HER129	46	±29	48	±13	5.8	±1.3

Sample	Th-230 Total pCi/l	Error 2σ	U Total mg/l	
HER129	1.6	±0.8	0.0005	This is a magnitude lower than the precision of the method used

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Apr-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 11-Mar-93 10:15

Job: 936525E

Status: Final

Sample Type: Water

Sample	Silver Total mg/l	Arsenic Total mg/l	Barium Total mg/l	Calcium Total mg/l	Cadmium Total mg/l	Chromium Total mg/l	Copper Total mg/l
HER134	<0.01	0.005	0.01	600	<0.005	<0.01	<0.01

Sample	Fluoride Total mg/l	Iron Total mg/l	Lead Total mg/l	Magnesium Total mg/l	Manganese Total mg/l	Mercury Total mg/l
HER134	2.1	4.62	<0.02	200	0.05	<0.0002

Sample	Potassium Total mg/l	Selenium Total mg/l	Sodium Total mg/l	Zinc Total mg/l	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l
HER134	22.8	<0.002	79.7	<0.005	152	152

Sample	CO3 as CaCO3 mg/l	Chloride mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l	NO3 mg/l
HER134	<1	38	6.90	3040	2790	<0.1

Sample	Phosphate Dissolved mg/l	Sulfate mg/l	Silicon Dissolved mg/l
HER134	<0.02	1960	6.23

BARRINGER LABORATORIES INC.
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12-Apr-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 11-Mar-93 10:15

Job: 936525E

Status: Final

Sample Type: Water

Sample	Gross Alpha Total pCi/l ± 2σ	Gross Beta Total pCi/l ± 2σ	Ra-226 Total pCi/l ± 2σ
HER134	23 ±22	27 ±14	9.0 ±1.5

Sample	Th-230 Total pCi/l ± 2σ	U Total mg/l	
HER134	0.4 ±0.6	0.0006	This is a magnitude lower than the precision of the method used

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 Ggolden, CO 80401 (303) 277-1687 FAX (303) 277-1689

16-Jul-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 21-Jun-93 09:45

Job: 937485E

Status: Final

Sample Type: Water

Sample Id	Silver Total mg/l	Arsenic Total mg/l	Barium Total mg/l	Calcium Total mg/l	Cadmium Total mg/l
HER 137	<0.01	<0.001	0.01	652	<0.005

Sample Id	Chromium Total mg/l	Copper Total mg/l	Fluoride Total mg/l	Iron Total mg/l	Lead Total mg/l
HER 137	<0.01	<0.01	2.8	4.77	<0.02

Sample Id	Magnesium Total mg/l	Manganese Total mg/l	Mercury Total mg/l	Potassium Total mg/l	Selenium Total mg/l
HER 137	208	0.06	<0.0002	23.4	<0.002

Sample Id	Sodium Total mg/l	Zinc Total mg/l	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l
HER 137	83.0	<0.005	162	162	<1

Sample Id	Chloride mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l	TSS mg/l
HER 137	37	6.93	2030	3450	8

Sample Id	NO3 as N mg/l	Phosphate mg/l	Sulfate mg/l	Silica Total mg/l
HER 137	<0.1	<0.1	2280	6.12

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

16-Jul-93

Mr. Lawrence Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

PO #:

Received: 21-Jun-93 09:45

Job: 937485E

Status: Final

Sample Type: Water

Sample Id	Gross Alpha Total pCi/l	± 2σ	Gross Beta Total pCi/l	± 2σ
HER 137	34	±25	58	±26

Sample Id	Ra-226 Total pCi/l	± 2σ	Ra-228 Total pCi/l	± 2σ
HER 137	9.3	±2.1	0.9	±1.9

Sample Id	Th-230 Total pCi/l	± 2σ	U Total mg/l
HER 137	0.2	±0.8	0.0022

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

BARRINGER LABORATORIES INC.
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27-Jan-94
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Status: Final

ENERGY FUELS NUCLEAR

Sample Id: HER148
Lab Id: 939356-1 **Project: HER148**
Date Sampled: 16-Dec-93 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Dissolved	200.7	U mg/l	0.01	17-Jan-94
Arsenic	Dissolved	206.2	U mg/l	0.001	5-Jan-94
Barium	Dissolved	200.7	0.01 mg/l	0.01	17-Jan-94
Calcium	Dissolved	200.7	628 mg/l	0.05	17-Jan-94
Cadmium	Dissolved	200.7	U mg/l	0.005	17-Jan-94
Chromium	Dissolved	200.7	U mg/l	0.01	17-Jan-94
Copper	Dissolved	200.7	U mg/l	0.01	17-Jan-94
Fluoride		300.0	3.0 mg/l	0.1	17-Jan-94
Iron	Dissolved	200.7	4.27 mg/l	0.02	17-Jan-94
Lead	Dissolved	200.7	U mg/l	0.02	17-Jan-94
Magnesium	Dissolved	200.7	212 mg/l	0.05	17-Jan-94
Manganese	Dissolved	200.7	0.05 mg/l	0.01	17-Jan-94
Mercury	Dissolved	245.1	U mg/l	0.0002	11-Jan-94
Potassium	Dissolved	200.7	24.0 mg/l	0.5	17-Jan-94
Selenium	Dissolved	270.2	U mg/l	0.002	5-Jan-94
Sodium	Dissolved	200.7	86.2 mg/l	0.05	17-Jan-94
Zinc	Dissolved	200.7	U mg/l	0.005	17-Jan-94
Alkalinity		310.1	160 mg/l	1	4-Jan-94
HCO3		310.1	160 mg/l	1	4-Jan-94
CO3		310.1	U mg/l	1	4-Jan-94
Chloride		300.0	38 mg/l	1	17-Jan-94
pH		150.1	7.02 unit	0.01	22-Dec-93
Spec. Cond.		120.1	3330 µmh/cm	1	7-Jan-94
TDS		160.1	3320 mg/l	4	27-Dec-93
NO3 as N		353.2	U mg/l	0.1	14-Jan-93
Phosphate as P		365.1	U mg/l	0.1	10-Jan-94
Sulfate		300.0	2200 mg/l	1	17-Jan-94
Silicon	Dissolved	200.7	6.50 mg/l	0.01	17-Jan-94

Meeting The Analytical Challenges Of A Changing World

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 Ggolden, CO 80401 (303) 277-1687 FAX (303) 277-1689

ENERGY FUELS NUCLEAR

Sample Id: HER148
Lab Id: 939356-1 **Project: HER148**
Date Sampled: 16-Dec-93 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Gross Alpha	Dissolved	51±20	pCi/l ✓	2	01/05-01/06
Gross Beta	Dissolved	46±14	pCi/l	4	01/05-01/06
Ra-226	Dissolved	10±2	pCi/l	0.3	01/10-01/24
Ra-228	Dissolved	0.4±1.4	pCi/l	1	01/04-01/07
Th-230	Dissolved	0.4±0.7	pCi/l	0.4	01/19-01/27
U	Dissolved	0.0003	mg/l	0.0003	12/29-01/04

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12-Apr-94
Page: R-1
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Status: Final

ENERGY FUELS NUCLEAR

Sample Id: HER150
Lab Id: 941486-1 **Project: Hermit Mine**
Date Sampled: 3-Mar-94 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	29-Mar-94
Arsenic	Total	206.2	0.002 mg/l	0.001	14-Mar-94
Barium	Total	200.7	0.01 mg/l	0.01	29-Mar-94
Calcium	Total	200.7	623 mg/l	0.05	29-Mar-94
Cadmium	Total	200.7	0.007 mg/l	0.005	29-Mar-94
Chromium	Total	200.7	U mg/l	0.01	29-Mar-94
Copper	Total	200.7	U mg/l	0.01	29-Mar-94
Fluoride	Total	300.0	2.8 mg/l	0.1	5-Apr-94
Iron	Total	200.7	4.24 mg/l	0.02	29-Mar-94
Lead	Total	200.7	U mg/l	0.02	29-Mar-94
Magnesium	Total	200.7	201 mg/l	0.05	29-Mar-94
Manganese	Total	200.7	0.05 mg/l	0.01	29-Mar-94
Mercury	Total	245.1	U mg/l	0.0002	24-Mar-94
Potassium	Total	200.7	21.1 mg/l	0.5	29-Mar-94
Selenium	Total	270.2	U mg/l	0.002	14-Mar-94
Sodium	Total	200.7	78.7 mg/l	0.05	29-Mar-94
Zinc	Total	200.7	U mg/l	0.005	29-Mar-94
Alkalinity		310.1	163 mg/l	1	25-Mar-94
HCO3		310.1	163 mg/l	1	25-Mar-94
CO3		310.1	U mg/l	1	25-Mar-94
Chloride		300.0	37 mg/l	1	5-Apr-94
pH		150.1	7.00 unit	0.01	11-Mar-94
Spec. Cond.		120.1	3434 µmh/cm	1	16-Mar-94
TDS		160.1	3250 mg/l	4	15-Mar-94
NO3 as N		353.2	U mg/l	0.1	31-Mar-94
Phosphate as P		365.1	U mg/l	0.1	8-Apr-94
Sulfate		300.0	2290 mg/l	1	5-Apr-94
Silicon	Total	200.7	6.30 mg/l	0.01	29-Mar-94

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

ENERGY FUELS NUCLEAR

Sample Id: HER150
Lab Id: 941486-1 **Project: Hermit Mine**
Date Sampled: 3-Mar-94 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Gross Alpha	Total	15±13	pCi/l	2	03/29-03/30
Gross Beta	Total	21±14	pCi/l	4	03/29-03/30
Ra-226	Total	8.9±1.3	pCi/l	0.3	03/17-03/23
Ra-228	Total	0.8±1.0	pCi/l	1	03/16-03/28
Th-230	Total	0.5±0.7	pCi/l	0.4	03/16-03/17
U	Total	U	mg/l	0.0003	03/23-03/28

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 Ggolden, CO 80401 (303) 277-1687 FAX (303) 277-1689

11-Jan-95
Page: R-1
Job: 943646E
Status: Final

ENERGY FUELS NUCLEAR

Sample Id: HER 167
Lab Id: 943646-1 **Project:**
Date Sampled: 9-Dec-94 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	29-Dec-94
Arsenic	Total	206.2	0.003 mg/l	0.003	29-Dec-94
Barium	Total	200.7	U mg/l	0.02	29-Dec-94
Calcium	Total	200.7	660 mg/l	0.2	29-Dec-94
Cadmium	Total	200.7	U mg/l	0.005	29-Dec-94
Chromium	Total	200.7	U mg/l	0.01	29-Dec-94
Copper	Total	200.7	U mg/l	0.01	29-Dec-94
Iron	Total	200.7	4.3 mg/l	0.1	29-Dec-94
Lead	Total	239.2	0.005 mg/l	0.002	29-Dec-94
Magnesium	Total	200.7	205 mg/l	0.1	29-Dec-94
Manganese	Total	200.7	0.055 mg/l	0.005	29-Dec-94
Mercury	Total	245.1	U mg/l	0.0002	21-Dec-94
Potassium	Total	200.7	23 mg/l	5	29-Dec-94
Selenium	Total	270.2	U mg/l	0.005	29-Dec-94
Sodium	Total	200.7	83 mg/l	1	29-Dec-94
Zinc	Total	200.7	U mg/l	0.02	29-Dec-94
Silica	Total	200.7	13 mg/l	2	29-Dec-94
Fluoride		300.0	3.2 mg/l	0.1	5-Jan-95
Alkalinity	Total	310.1	159 mg/l	1	28-Dec-94
Alkalinity	HCO3	310.1M	159 mg/l	1	28-Dec-94
Alkalinity	CO3	310.1M	U mg/l	1	28-Dec-94
Chloride		300.0	39 mg/l	1	5-Jan-95
pH		150.1	7.06 unit	0.01	20-Dec-94
Spec. Cond.		120.1	3270 µmh/cm	1	20-Dec-94
TDS		160.1	3240 mg/l	10	16-Dec-94
Nitrate as N		300.0	U mg/l	0.1	5-Jan-95
ortho-Phosphate		365.1	U mg/l	0.02	22-Dec-94
Sulfate		300.0	2240 mg/l	1	5-Jan-95

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ENERGY FUELS NUCLEAR

Sample Id: HER 167
Lab Id: 943646-1 **Project:**
Date Sampled: 9-Dec-94 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Gross Alpha	Total	11±17	pCi/l	2	12/19-12/20
Gross Beta	Total	12±12	pCi/l	4	12/19-12/20
Ra-226	Total	7.4±0.8	pCi/l	0.2	12/20-12/22
Ra-228	Total	0.9±0.7	pCi/l	1	12/23-12/29
Th-230	Total	0.4±0.3	pCi/l	0.2	12/20-12/22

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ENERGY FUELS NUCLEAR

Sample Id: HER 167
Lab Id: 943646-1 **Project:**
Date Sampled: 9-Dec-94 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Uranium	Total	0.0019	mg/l	0.0003	12/19-12/20

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

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27-Jul-95
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Job: 952511E
Status: Final

ENERGY FUELS NUCLEAR

Sample Id: HER 176
Lab Id: 952511-1 **Project:**
Date Sampled: 21-Jun-95 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	11-Jul-95
Arsenic	Total	206.2	U mg/l	0.003	12-Jul-95
Barium	Total	200.7	U mg/l	0.02	11-Jul-95
Calcium	Total	200.7	592 mg/l	0.2	11-Jul-95
Cadmium	Total	200.7	U mg/l	0.005	11-Jul-95
Chromium	Total	200.7	U mg/l	0.01	11-Jul-95
Copper	Total	200.7	U mg/l	0.01	11-Jul-95
Iron	Total	200.7	4.1 mg/l	0.1	11-Jul-95
Lead	Total	239.2	0.005 mg/l	0.002	11-Jul-95
Magnesium	Total	200.7	197 mg/l	0.1	11-Jul-95
Manganese	Total	200.7	0.046 mg/l	0.005	11-Jul-95
Mercury	Total	245.1	U mg/l	0.0002	10-Jul-95
Potassium	Total	200.7	22 mg/l	5	11-Jul-95
Selenium	Total	270.2	U mg/l	0.005	11-Jul-95
Sodium	Total	200.7	79 mg/l	1	11-Jul-95
Zinc	Total	200.7	U mg/l	0.02	11-Jul-95
Fluoride		300.0	1.1 mg/l	0.2	28-Jun-95
Alkalinity	CO3	310.1M	U mg/l	1	6-Jul-95
Alkalinity	HCO3	310.1M	172 mg/l	1	6-Jul-95
Chloride		300.0	35 mg/l	2	28-Jun-95
pH		150.1	7.25 unit	0.01	28-Jun-95
Spec. Cond.		120.1	3420 µmh/cm	1	6-Jul-95
TDS		160.1	3200 mg/l	10	29-Jun-95
Nitrate as N		300.0	U mg/l	0.2	28-Jun-95
Phosphorus	Total	365.1	U mg/l	0.05	5-Jul-95
Sulfate		300.0	2180 mg/l	50	28-Jun-95
Silica	Total	200.7	13 mg/l	2	11-Jul-95

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ENERGY FUELS NUCLEAR

Sample Id: HER 176
Lab Id: 952511-1 **Project:**
Date Sampled: 21-Jun-95 **Matrix: Water**

Analyte	Fraction	Conc.± 2σ		LLD	Date Analyzed
Gross Alpha	Total	53±25	pCi/l	2	07/18-07/24
Gross Beta	Total	60±20	pCi/l	4	07/18-07/24
Ra-226	Total	10±1	pCi/l	0.3	07/07-07/10
Ra-228	Total	0.4±0.9	pCi/l	1	07/12-07/18
Th-230	Total	0.6±0.6	pCi/l	0.4	07/24-07/26

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ENERGY FUELS NUCLEAR

Sample Id: HER 176
Lab Id: 952511-1 **Project:**
Date Sampled: 21-Jun-95 **Matrix: Water**

Analyte	Fraction	Conc.		LLD	Date Analyzed
Uranium	Total	0.0007	mg/l	0.0003	07/10-07/12

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

https://www.astm.org/d2907-97.html

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ENERGY FUELS NUCLEAR

Sample Id: HER183
Lab Id: 953896-1 **Project:**
Date Sampled: 14-Nov-95 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	22-Nov-95
Arsenic	Total	206.2	*U mg/l	0.003	7-Dec-95
Barium	Total	200.7	U mg/l	0.02	22-Nov-95
Calcium	Total	200.7	652 mg/l	0.2	22-Nov-95
Cadmium	Total	200.7	U mg/l	0.005	22-Nov-95
Chromium	Total	200.7	U mg/l	0.01	22-Nov-95
Copper	Total	200.7	U mg/l	0.01	22-Nov-95
Iron	Total	200.7	4.5 mg/l	0.1	22-Nov-95
Lead	Total	239.2	U mg/l	0.002	8-Dec-95
Magnesium	Total	200.7	217 mg/l	0.1	22-Nov-95
Manganese	Total	200.7	0.055 mg/l	0.005	22-Nov-95
Mercury	Total	245.1	U mg/l	0.0002	5-Dec-95
Potassium	Total	200.7	22 mg/l	5	28-Nov-95
Selenium	Total	270.2	U mg/l	0.005	7-Dec-95
Sodium	Total	200.7	87 mg/l	1	22-Nov-95
Zinc	Total	200.7	U mg/l	0.02	22-Nov-95
Fluoride		340.2	1.7 mg/l	0.1	30-Nov-95
Alkalinity	CO3	310.1M	U mg/l	5	21-Nov-95
Alkalinity	HCO3	310.1M	164 mg/l	5	21-Nov-95
Chloride		300.0	36 mg/l	1	6-Dec-95
pH		150.1	7.07 unit	0.01	21-Nov-95
Spec. Cond.		120.1	3410 µmh/cm	1	21-Nov-95
TDS		160.1	3220 mg/l	10	21-Nov-95
Nitrate as N		300.0	U mg/l	0.1	6-Dec-95
ortho-Phosphate		365.1	U mg/l	0.05	27-Nov-95
Sulfate		300.0	2280 mg/l	25	6-Dec-95
Silica	Total	200.7	14 mg/l	2	22-Nov-95

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ENERGY FUELS NUCLEAR

Analyte: Gross Alpha **Project:**
Fraction: Dissolved **Date Analyzed: 11/27-12/01**
Method: 900.0 **LLD: 2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	15±17	2

Analyte: Gross Beta **Project:**
Fraction: Dissolved **Date Analyzed: 11/27-12/01**
Method: 900.0 **LLD: 4**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	44±17	4

Analyte: Ra-226 **Project:**
Fraction: Dissolved **Date Analyzed: 11/28-12/04**
Method: SM-705 **LLD: 0.2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	7.3±0.8	0.2

Analyte: Ra-228 **Project:**
Fraction: Dissolved **Date Analyzed: 11/22-11/29**
Method: Perc/Brooks **LLD: 1**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	1.1±0.9	1

Analyte: Th-230 **Project:**
Fraction: Dissolved **Date Analyzed: 12/04-12/07**
Method: USAEC **LLD: 0.2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
953896-1	14-Nov-95	Water	HER183	0.0±0.1	0.2

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ENERGY FUELS NUCLEAR

Analyte: Uranium **Project:**
Fraction: Dissolved **Date Analyzed: 11/27-11/28**
Method: ASTM D2907 **LLD: 0.0003**
Units: mg/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	LLD
953896-1	14-Nov-95	Water	HER183	U	0.0003

https://www.astm.org/d2907-97.html

This is a magnitude lower than the precision of the method used

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19-Jun-96
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Job: 962009E
Status: Final

ENERGY FUELS NUCLEAR

Sample Id: HER189
Lab Id: 962009-1 **Project:**
Date Sampled: 15-May-96 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	3-Jun-96
Arsenic	Total	206.2	U mg/l	0.003	3-Jun-96
Barium	Total	200.7	U mg/l	0.02	3-Jun-96
Calcium	Total	200.7	617 mg/l	0.2	3-Jun-96
Cadmium	Total	200.7	U mg/l	0.005	3-Jun-96
Chromium	Total	200.7	U mg/l	0.01	3-Jun-96
Copper	Total	200.7	U mg/l	0.01	3-Jun-96
Iron	Total	200.7	4.7 mg/l	0.1	3-Jun-96
Lead	Total	239.2	U mg/l	0.002	3-Jun-96
Magnesium	Total	200.7	208 mg/l	0.1	3-Jun-96
Manganese	Total	200.7	0.046 mg/l	0.005	3-Jun-96
Mercury	Total	245.1	U mg/l	0.0002	6-Jun-96
Potassium	Total	200.7	21 mg/l	5	6-Jun-96
Selenium	Total	270.2	U mg/l	0.005	3-Jun-96
Sodium	Total	200.7	76 mg/l	1	6-Jun-96
Zinc	Total	200.7	U mg/l	0.02	3-Jun-96
Fluoride		340.2	1.6 mg/l	0.1	1-Jun-96
Alkalinity	CO3	310.1M	U mg/l	1	23-May-96
Alkalinity	HCO3	310.1M	165 mg/l	1	23-May-96
Chloride		300.0	38 mg/l	1	28-May-96
pH		150.1	7.84 unit	0.01	23-May-96
Spec. Cond.		120.1	3380 µmh/cm	1	23-May-96
TDS		160.1	3360 mg/l	10	23-May-96
Nitrate as N		300.0	U mg/l	0.1	28-May-96
ortho-Phosphate		365.1	U mg/l	0.02	3-Jun-96
Sulfate		300.0	2500 mg/l	25	28-May-96
Silica	Dissolved	200.7	14 mg/l	2	3-Jun-96

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ENERGY FUELS NUCLEAR

Analyte: Gross Alpha **Project:**
Fraction: Dissolved **Date Analyzed: 06/10-06/18**
Method: 900.0 **LLD: 43**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962009-1	15-May-96	Water	HER189	35±21	43

Analyte: Gross Beta **Project:**
Fraction: Dissolved **Date Analyzed: 06/10-06/18**
Method: 900.0 **LLD: 32**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962009-1	15-May-96	Water	HER189	30±25	32

Analyte: Ra-226 **Project:**
Fraction: Dissolved **Date Analyzed: 05/23-05/28**
Method: SM-705 **LLD: 0.2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962009-1	15-May-96	Water	HER189	4.3±0.7	0.2

Analyte: Ra-228 **Project:**
Fraction: Dissolved **Date Analyzed: 05/29-06/03**
Method: Perc/Brooks **LLD: 1**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962009-1	15-May-96	Water	HER189	1.0±0.7	1

Analyte: Th-230 **Project:**
Fraction: Dissolved **Date Analyzed: 05/23-06/03**
Method: USAEC **LLD: 0.2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962009-1	15-May-96	Water	HER189	0.0±0.4	0.2

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ENERGY FUELS NUCLEAR

Analyte: Uranium **Project:**
Fraction: Dissolved **Date Analyzed: 05/28-05/30**
Method: ASTM D2907 **LLD: 0.0003**
Units: mg/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	LLD
962009-1	15-May-96	Water	HER189	0.0018	0.0003

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22-Aug-96
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Job: 962678E
Status: Final

ENERGY FUELS NUCLEAR

Sample Id: HER 192
Lab Id: 962678-1 **Project:**
Date Sampled: 31-Jul-96 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	20-Aug-96
Arsenic	Total	206.2	U mg/l	0.003	20-Aug-96
Barium	Total	200.7	U mg/l	0.02	20-Aug-96
Calcium	Total	200.7	604 mg/l	0.2	20-Aug-96
Cadmium	Total	200.7	U mg/l	0.005	20-Aug-96
Chromium	Total	200.7	U mg/l	0.01	20-Aug-96
Copper	Total	200.7	U mg/l	0.01	20-Aug-96
Iron	Total	200.7	4.0 mg/l	0.1	20-Aug-96
Lead	Total	239.2	U mg/l	0.002	20-Aug-96
Magnesium	Total	200.7	202 mg/l	0.1	20-Aug-96
Manganese	Total	200.7	0.044 mg/l	0.005	20-Aug-96
Mercury	Total	245.1	0.0002 mg/l	0.0002	13-Aug-96
Potassium	Total	200.7	22 mg/l	5	20-Aug-96
Selenium	Total	270.2	U mg/l	0.005	20-Aug-96
Sodium	Total	200.7	81 mg/l	1	20-Aug-96
Zinc	Total	200.7	U mg/l	0.02	20-Aug-96
Fluoride		340.2	1.7 mg/l	0.1	12-Aug-96
Alkalinity	CO3	310.1M	U mg/l	1	5-Aug-96
Alkalinity	HCO3	310.1M	160 mg/l	1	5-Aug-96
Chloride		300.0	36 mg/l	3	15-Aug-96
pH		150.1	7.20 unit	0.01	5-Aug-96
Spec. Cond.		120.1	3370 µmh/cm	1	7-Aug-96
TDS		160.1	3340 mg/l	10	6-Aug-96
Nitrate as N		353.2	0.1 mg/l	0.1	2-Aug-96
ortho-Phosphate		365.1	U mg/l	0.02	2-Aug-96
Sulfate		300.0	2240 mg/l	25	15-Aug-96
Silica	Total	200.7	14 mg/l	2	20-Aug-96

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ENERGY FUELS NUCLEAR

Analyte: Gross Alpha **Project:**
Fraction: Total **Date Analyzed: 08/06-08/13**
Method: 900.0 **LLD: 38**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	18±18	38

Analyte: Gross Beta **Project:**
Fraction: Total **Date Analyzed: 08/06-08/13**
Method: 900.0 **LLD: 70**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	5±31	70

Analyte: Ra-226 **Project:**
Fraction: Total **Date Analyzed: 08/08-08/13**
Method: SM-705 **LLD: 0.1**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	7.5±0.8	0.1

Analyte: Ra-228 **Project:**
Fraction: Total **Date Analyzed: 08/16-08/19**
Method: Perc/Brooks **LLD: 2**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	0.0±1.0	2

Analyte: Th-230 **Project:**
Fraction: Total **Date Analyzed: 08/13-08/19**
Method: USAEC **LLD: 0.6**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
962678-1	31-Jul-96	Water	HER 192	0.0±0.4	0.6

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Job: 962678E
Status: Final

ENERGY FUELS NUCLEAR

Analyte: Uranium
Fraction: Total
Method: ASTM D2907
Units: mg/l

Project:
Date Analyzed: 08/19-08/20
LLD: 0.0003

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	LLD
962678-1	31-Jul-96	Water	HER 192	0.0011	0.0003

https://www.astm.org/d2907-97.html

This is a magnitude lower than the precision of the method used

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Job: 972579E
Status: Final

INTERNATIONAL URANIUM (USA) CORPORATION

Sample Id: HER208
Lab Id: 972579-2 **Project:**
Date Sampled: 18-Jun-97 **Matrix: Water**

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Silver	Total	200.7	U mg/l	0.01	8-Jul-97
Arsenic	Total	206.2	0.005 mg/l	0.003	3-Jul-97
Barium	Total	200.7	U mg/l	0.02	8-Jul-97
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Cadmium	Total	200.7	U mg/l	0.005	8-Jul-97
Chromium	Total	200.7	U mg/l	0.01	8-Jul-97
Copper	Total	200.7	U mg/l	0.01	8-Jul-97
Iron	Total	200.7	2.1 mg/l	0.1	8-Jul-97
Lead	Total	239.2	U mg/l	0.002	3-Jul-97
Magnesium	Total	200.7	199 mg/l	0.1	8-Jul-97
Manganese	Total	200.7	0.040 mg/l	0.005	8-Jul-97
Mercury	Total	245.1	U mg/l	0.0002	11-Jul-97
Potassium	Total	200.7	21 mg/l	5	8-Jul-97
Selenium	Total	270.2	U mg/l	0.005	3-Jul-97
Sodium	Total	200.7	82 mg/l	1	8-Jul-97
Zinc	Total	200.7	U mg/l	0.02	8-Jul-97
[redacted]		[redacted]	[redacted]	[redacted]	[redacted]
Alkalinity	CO3	310.1M	U mg/l	1	26-Jun-97
Alkalinity	HCO3	310.1M	160 mg/l	1	26-Jun-97
Chloride		300.0	37 mg/l	2.0	15-Jul-97
pH		150.1	7.85 unit	0.01	26-Jun-97
Spec. Cond.		120.1	3100 µmh/cm	1	27-Jun-97
TDS		160.1	3320 mg/l	10	23-Jul-97
Nitrate as N		353.2	U mg/l	0.1	20-Jun-97
ortho-Phosphate		365.1	U mg/l	0.05	27-Jun-97
Sulfate		300.0	2340 mg/l	20	15-Jul-97
Silica	Total	200.7	14 mg/l	2	8-Jul-97

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INTERNATIONAL URANIUM (USA) CORPORATION

Analyte: Gross Alpha **Project:**
Fraction: Dissolved **Date Analyzed: 07/11-07/12**
Method: 900.0 **LLD: sample specific**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
[redacted]					99
972579-2	18-Jun-97	Water	HER208	36±26	56

Analyte: Gross Beta **Project:**
Fraction: Dissolved **Date Analyzed: 07/11-07/21**
Method: 900.0 **LLD: sample specific**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
[redacted]					120
972579-2	18-Jun-97	Water	HER208	8±47	103

Analyte: Ra-226 **Project:**
Fraction: Dissolved **Date Analyzed: 07/17-07/23**
Method: SM-705 **LLD: 0.1**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
[redacted]					0.1
[redacted]					0.1

Analyte: Th-230 **Project:**
Fraction: Dissolved **Date Analyzed: 06/26-07/17**
Method: USAEC **LLD: 0.3**
Units: pCi/l

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ	LLD
[redacted]					
972579-2	18-Jun-97	Water	HER208	0.2±0.4	0.3

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INTERNATIONAL URANIUM (USA) CORPORATION

Analyte: Uranium
Fraction: Dissolved
Method: ASTM D2907
Units: mg/l

Project:
Date Analyzed: 07/21-07/22
LLD: 0.0009

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	LLD
[redacted]					
972579-2	18-Jun-97	Water	HER208	U	0.0009

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

https://www.astm.org/d2907-97.html

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Same client ID as Barringer Labs 6/18/1997 sample

Lab Sample ID: *L14367-01*
Client Sample ID: *HER 208*
Client Project ID: *Hermit Mine Water*
ACZ Report ID: *RG46961*

International Uranium(U.S.A.) Corp.
2555 N. Hwy. 89A,HC 64 Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *6/18/97 13:30*
Date Received: *6/20/97*
Date Reported: *7/11/97*

Sample Matrix: *Ground Water*

Metals Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Calcium, total	M200.7 ICP	585		mg/L	0.2	1	7/11/97	ss
Magnesium, total	M200.7 ICP	199		mg/L	0.2	1	7/11/97	ss
[redacted]								

Metals Prep

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010 ICP						7/10/97	tw

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Fluoride	M340.2 - ISE	1.5		mg/L	0.1	0.5	7/10/97	kr
[redacted]								

Why are some results blocked out?

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL
B = Analyte concentration detected at a value between MDL and PQL
PQL = Practical Quantitation Limit

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Spgs, CO 80487
(800) 334-5493

International Uranium(U.S.A) Corp.
2555 N. Hwy. 89A, HC 64 Box 153
Fredonia, AZ 86022

Att: Mr. Lawrence L. Casebolt

Lab Sample ID: ***L14367-01***
Client Sample ID: *HER 208*
Client Project ID: *Hermit Mine Water*
ACZ Report ID: *RC2160*

Date Sampled: *6/18/97*
Date Received: *6/20/97*
Date Reported: *7/11/97*

Matrix: *water*

Parameter	EPA Method	Result	Error (+/-)	Qual	Units	MDL	PQL	Date	Analyst
Ra226	SM7500	9.5	1.2		pCi/L	1	5	10-Jul-97	cbr

Remarks:

Inorganic Qualifiers (based on EPA CLP 3/90)

< = Analyte at a concentration less than the detection limit
B = Concentration for analyte estimated between MDL and PQL
PQL = Practical Quantitation Limit

VP-Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L16914-01***
Client Sample ID: *HER 218*
Client Project ID: *Hermit Mine Water Wl*
ACZ Report ID: *RG59870*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *12/30/97 16:00*
Date Received: *1/2/98*
Date Reported: *1/13/98*

Sample Matrix: *Ground Water*

Metals Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Arsenic, dissolved	M206.2 GFAA	0.001	B	mg/L	0.001	0.005	1/2/98	jb
Barium, dissolved	M200.7 ICP		U	mg/L	0.02	0.05	1/5/98	jaw
Cadmium, dissolved	M213.2 GFAA		U	mg/L	0.0005	0.003	1/6/98	kr
Calcium, dissolved	M200.7 ICP	596		mg/L	1	5	1/5/98	jaw
Chromium, dissolved	M218.2 GFAA		U	mg/L	0.001	0.005	1/8/98	kr
Copper, dissolved	M220.2 GFAA		U	mg/L	0.001	0.005	1/3/98	jb
Iron, dissolved	M200.7 ICP	2.51		mg/L	0.05	0.3	1/5/98	jaw
Lead, dissolved	M239.2 GFAA		U	mg/L	0.001	0.005	1/5/98	kr
Magnesium, dissolved	M200.7 ICP	194		mg/L	1	5	1/5/98	jaw
Manganese, dissolved	M200.8 ICP-MS	0.050		mg/L	0.002	0.01	1/9/98	fep
Mercury, dissolved	M245.1 CVAA		U	mg/L	0.0002	0.001	1/5/98	bg
Potassium, dissolved	M200.7 ICP	20		mg/L	2	5	1/5/98	jaw
Selenium, dissolved	M270.2 GFAA		U	mg/L	0.01	0.05	1/7/98	fp
Silica, dissolved	M200.7 ICP	13		mg/L	1	3	1/5/98	jaw
Silver, dissolved	M272.2 GFAA		U	mg/L	0.0005	0.003	1/7/98	fp
Sodium, dissolved	M200.7 ICP	75		mg/L	2	5	1/5/98	jaw
Uranium, dissolved	M200.8 ICP-MS	0.0007	B	mg/L	0.0005	0.003	1/9/98	fep
Zinc, dissolved	M289.2 GFAA	0.002	B	mg/L	0.001	0.005	1/13/98	fp

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	M2320B							
Bicarbonate as CaCO3		166		mg/L	2	10	1/2/98	sts
Carbonate as CaCO3			U	mg/L	2	10	1/2/98	sts
Hydroxide as CaCO3			U	mg/L	2	10	1/2/98	sts
Total Alkalinity		166		mg/L	2	10	1/2/98	sts
Cation-Anion Balance	Calculation							
Cation-Anion Balance		-0.5		%			1/13/98	calc
Sum of Anions		50.2		meq/L	0.1	0.5	1/13/98	calc
Sum of Cations		49.7		meq/L	0.1	0.5	1/13/98	calc
Chloride	M325.2 - Colorimetric (RFA)	35		mg/L	1	5	1/7/98	jb/mc
Conductivity @25C	M120.1 - Meter	3250		umhos/cm	1	10	1/2/98	sts
Fluoride	M340.2 - ISE	1.5		mg/L	0.1	0.5	1/12/98	sts
Nitrate as N, dissolved	M353.2 - Automated Cadmium Reduction	0.02	B	mg/L	0.02	0.1	1/2/98	ss
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	0.02	B	mg/L	0.02	0.1	1/2/98	ss
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		U	mg/L	0.01	0.05	1/2/98	ss

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

RV Poulsen

Vice President of Operations: Ralph Poulsen

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

ACZ Project ID: *L17178*
Client Project ID: *Hermit Mine Water WL*
ACZ Report ID: *RG61048*

Date Sampled: *12/30/97*
Date Received: *1/2/98*
Date Reported: *2/2/98*

Radiochemistry

								Preparation			Analysis		
ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Method	Date	Analyst	Method	Date	Analyst
L17178-01	HER 218	Ground Water	Thorium 230, dissolved	0.2	0.1	0.18	pCi/L				ESM 4506	1/31/98	cbr

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

REPRC001Radchem Default98.01.02

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

ACZ Project ID: *L16914*
Client Project ID: *Hermit Mine Water Wl*
ACZ Report ID: *RG60094*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *12/30/97*
Date Received: *1/2/98*
Date Reported: *1/16/98*

Radiochemistry

								Preparation			Analysis		
ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Method	Date	Analyst	Method	Date	Analyst
L16914-01	HER 218	Ground Water	Gross Alpha	13	13	11	pCi/L	Method	1/14/98	jjs	SM7110 B	1/15/98	cbr
			Gross Beta	32	13	16	pCi/L	Method	1/14/98	jjs	SM7110 B	1/15/98	cbr
			Radium 226, dissolved	11.1	1	0.81	pCi/L	Method	1/13/98	jjs	SM7500 B	1/15/98	cbr
			Radium 228	1.65	0.53	1.1	pCi/L	Method	1/14/98	jjs	M9320	1/16/98	cbr

Notes:
RC970813-1
RC971209-2

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

RV Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L16914-01***
Client Sample ID: *HER 218*
Client Project ID: *Hermit Mine Water Wl*
ACZ Report ID: *RG59870*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *12/30/97 16:00*
Date Received: *1/2/98*
Date Reported: *1/13/98*

Sample Matrix: *Ground Water*

pH (lab)	M150.1 - Electrometric	7.0		units	0.1	0.1	1/2/98	sts
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid		U	mg/L	0.005	0.03	1/2/98	ss
Residue, Filterable (TDS) @180C	M160.1 - Gravimetric	3460		mg/L	10	20	1/5/98	sts
Sulfate	M375.3 - Gravimetric	2180		mg/L	10	20	1/5/98	cj
TDS (calculated)	Calculation	3220		mg/L	10	50	1/13/98	calc
TDS (ratio - measured/calculated)	Calculation	1.08					1/13/98	calc

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

RVP

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L19143-02***
Client Sample ID: *HER223*
Client Project ID:
ACZ Report ID: *RG72276*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *6/25/98 11:00*
Date Received: *6/26/98*
Date Reported: *7/20/98*

Sample Matrix: *Ground Water*

Metals Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Arsenic, total	M206.2 GFAA	0.002	B	mg/L	0.001	0.005	7/8/98	jb
Barium, total	M200.7 ICP	0.013	B	mg/L	0.006	0.02	7/10/98	gg
Cadmium, total	M213.2 GFAA		U	mg/L	0.0005	0.003	7/4/98	jb
Calcium, total	M200.7 ICP	561		mg/L	0.4	2	7/10/98	gg
Chromium, total	M218.2 GFAA		U	mg/L	0.001	0.005	7/11/98	jb
Copper, total	M220.2 GFAA		U	mg/L	0.001	0.005	7/11/98	jb
Iron, total	M200.7 ICP	5.91		mg/L	0.02	0.1	7/10/98	gg
Lead, total	M239.2 GFAA		U	mg/L	0.001	0.005	7/10/98	jb
Magnesium, total	M200.7 ICP	190		mg/L	0.4	2	7/10/98	gg
Manganese, total	M200.8 ICP-MS	0.084		mg/L	0.002	0.01	7/14/98	fep
Mercury, total	M245.1 CVAA		U	mg/L	0.0002	0.001	7/10/98	bg
Potassium, total	M200.7 ICP	20.6		mg/L	0.6	2	7/10/98	gg
Selenium, total	SM 3500-Se C, AA-Hydride		U	mg/L	0.001	0.005	7/9/98	bg
Silica, total	M200.7 ICP	12.5		mg/L	0.4	1	7/10/98	gg
Silver, total	M272.2 GFAA		U	mg/L	0.0005	0.003	7/8/98	jb
Sodium, total	M200.7 ICP	74.2		mg/L	0.6	2	7/10/98	gg
Uranium, total	M200.8 ICP-MS		U	mg/L	0.0005	0.003	7/14/98	fep
Zinc, total	M200.7 ICP		U	mg/L	0.02	0.1	7/10/98	gg

Metals Prep

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010 ICP						7/10/98	ms
Total Hot Plate Digestion	M3010 GFAA						7/7/98	laa
Total Hot Plate Digestion	M3010 ICP-MS						7/13/98	ms

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	M2320B							
Bicarbonate as CaCO3		163		mg/L	2	10	7/8/98	sts
Carbonate as CaCO3			U	mg/L	2	10	7/8/98	sts
Hydroxide as CaCO3			U	mg/L	2	10	7/8/98	sts
Total Alkalinity		163		mg/L	2	10	7/8/98	sts
Chloride	M325.2 - Colorimetric (RFA)	35		mg/L	1	5	7/8/98	mh
Conductivity @25C	M120.1 - Meter	3350		umhos/cm	1	10	7/8/98	sts
Fluoride	M340.2 - ISE	1.4		mg/L	0.1	0.5	7/9/98	bk
Lab Filtration	***						6/29/98	ms
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2	0.04	B	mg/L	0.02	0.1	7/20/98	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	0.04	B	mg/L	0.02	0.1	6/26/98	ss
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		U	mg/L	0.01	0.05	6/26/98	ss

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L19143-02***
Client Sample ID: *HER223*
Client Project ID:
ACZ Report ID: *RG72276*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *6/25/98 11:00*
Date Received: *6/26/98*
Date Reported: *7/20/98*

Sample Matrix: *Ground Water*

pH (lab)	M150.1 - Electrometric	7.4		units	0.1	0.1	7/8/98	sts
Phosphate	Calculation based on Ortho Phosphorus		U	mg/L	0.03	0.15	7/20/98	calc
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid		U	mg/L	0.005	0.03	6/26/98	ss
Residue, Filterable (TDS) @180C	M160.1 - Gravimetric	3520		mg/L	10	20	7/2/98	cj/cd
Sulfate	M375.3 - Gravimetric	2120		mg/L	10	20	7/9/98	bk

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

RVP

Vice President of Operations: Ralph Poulsen

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

ACZ Project ID: *L19143*
Client Project ID:
ACZ Report ID: *RG72739*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *6/24/98*
Date Received: *6/26/98*
Date Reported: *7/23/98*

Radiochemistry

ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Preparation Method	Preparation Date	Preparation Analyst	Analysis Method	Analysis Date	Analysis Analyst
L19143-02	HER223	Ground Water	Gross Alpha	9	14	12	pCi/L	Method	7/17/98	jd	M9310	7/17/98	cbr
			Gross Beta	32	12	15	pCi/L	Method	7/17/98	jd	M9310	7/17/98	cbr
			Radium 228, total	1.8	1.3	2.6	pCi/L	Method	7/9/98	jd	M9320	7/14/98	cbr
			Thorium 230, total	0.46	0.3	0.2	pCi/L	Method	7/17/98	jd	ESM 4506	7/21/98	jd

Gross Beta is higher than Gross Alpha

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

REPRC001.98.01.02

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

ACZ Project ID: *L19578*
Client Project ID:
ACZ Report ID: *RG74211*

Date Sampled: *6/24/98*
Date Received: *7/28/98*
Date Reported: *8/6/98*

Radiochemistry

								Preparation			Analysis		
ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Method	Date	Analyst	Method	Date	Analyst
L19578-02	HER223	Ground Water	Radium 226, total	10.99	0.87	0.57	pCi/L	Method	7/31/98	jd	M9315	7/31/98	cbr

Ra 226 is higher than Gross Alpha
U is greatest contributor to gross alpha

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

REPRC001.98.01.02

R V Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L21309-01***
Client Sample ID: *HER228*
Client Project ID: *Hermit Mine*
ACZ Report ID: *RG83428*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *11/23/98 18:30*
Date Received: *11/25/98*
Date Reported: *12/21/98*

Sample Matrix: *Ground Water*

Metals Analysis

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Arsenic, total	M206.2 GFAA	0.002	B	mg/L	0.002	0.01	12/11/98	jb
Barium, total	M200.7 ICP	0.012	B	mg/L	0.006	0.02	12/11/98	kr
Cadmium, total	M213.2 GFAA		U	mg/L	0.0005	0.003	12/17/98	jb
Calcium, total	M200.7 ICP	552		mg/L	0.4	2	12/11/98	kr
Chromium, total	M218.2 GFAA		U	mg/L	0.001	0.005	12/12/98	jb
Copper, total	M220.2 GFAA		U	mg/L	0.001	0.005	12/12/98	jb
Iron, total	M200.7 ICP	19.30		mg/L	0.02	0.1	12/11/98	kr
Lead, total	M239.2 GFAA		U	mg/L	0.001	0.005	12/11/98	jb
Magnesium, total	M200.7 ICP	193		mg/L	0.4	2	12/11/98	kr
Manganese, total	M200.8 ICP-MS	0.341		mg/L	0.002	0.01	12/5/98	fep
Mercury, total	M245.1 CVAA		U	mg/L	0.0002	0.001	12/4/98	bg
Potassium, total	M200.7 ICP	21.0		mg/L	0.6	2	12/11/98	kr
Selenium, total	SM 3500-Se C, AA-Hydride		U	mg/L	0.001	0.005	12/3/98	bg
Silica, dissolved	M200.7 ICP	5.7		mg/L	0.4	1	12/11/98	gg
Silver, total	M272.2 GFAA		U	mg/L	0.0005	0.003	12/12/98	jb
Sodium, total	M200.7 ICP	76.6		mg/L	0.6	2	12/11/98	kr
Uranium, total	M200.8 ICP-MS	0.001	B	mg/L	0.001	0.005	12/8/98	fep
Zinc, total	M200.7 ICP		U	mg/L	0.02	0.1	12/11/98	kr

Metals Prep

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M3010 ICP						12/10/98	laa
Total Hot Plate Digestion	M3010 GFAA						12/11/98	bg
Total Hot Plate Digestion	M3010 ICP-MS						12/4/98	laa

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	M2320B							
Bicarbonate as CaCO3		118		mg/L	2	10	12/4/98	sts
Carbonate as CaCO3			U	mg/L	2	10	12/4/98	sts
Hydroxide as CaCO3			U	mg/L	2	10	12/4/98	sts
Total Alkalinity		118		mg/L	2	10	12/4/98	sts
Chloride	M325.2 - Colorimetric (RFA)	37		mg/L	1	5	12/11/98	jl
Conductivity @25C	M120.1 - Meter	3200		umhos/cm	1	10	12/4/98	sts
Fluoride	M340.2 - ISE	1.4		mg/L	0.1	0.5	11/28/98	cd
Lab Filtration	***						11/27/98	als

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

R Poulsen

Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

Lab Sample ID: ***L21309-01***
Client Sample ID: *HER228*
Client Project ID: *Hermit Mine*
ACZ Report ID: *RG83428*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *11/23/98 18:30*
Date Received: *11/25/98*
Date Reported: *12/21/98*

Sample Matrix: *Ground Water*

Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2	0.03	B	mg/L	0.02	0.1	12/21/98	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	0.03	B	mg/L	0.02	0.1	11/25/98	ss
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		U	mg/L	0.01	0.05	11/25/98	ss
pH (lab)	M150.1 - Electrometric	6.9		units	0.1	0.1	12/4/98	sts
Phosphate	Calculation based on Ortho Phosphorus		U	mg/L	0.03	0.15	12/21/98	calc
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	0.007	B	mg/L	0.005	0.03	12/3/98	ss
Residue, Filterable (TDS) @180C	M160.1 - Gravimetric	3290		mg/L	10	20	11/28/98	cd
Sulfate	M375.3 - Gravimetric	1900		mg/L	10	20	12/2/98	mh/cd

Note: Sample required re-analysis for Ortho Phosphorus after the applicable holdtime had expired. Retest value correlates with data from original analysis, performed within holdtime.

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

RVP

Vice President of Operations: Ralph Poulsen

ACZ

Radiochemistry Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

ACZ Project ID: *L21309*
Client Project ID: *Hermit Mine*
ACZ Report ID: *RG84329*

International Uranium (U.S.A.) Corp.
2555 N. Hwy. 89A, HC 64, Box 153
Fredonia, AZ 86022
Mr. Lawrence L. Casebolt

Date Sampled: *11/23/98*
Date Received: *11/25/98*
Date Reported: *1/4/99*

Radiochemistry

								Preparation			Analysis		
ACZ ID	Client ID	Matrix	Parameter	Result	Error(+/-)	MDA	Units	Method	Date	Analyst	Method	Date	Analyst
L21309-01	HER228	Ground Water	Gross Alpha	47	19	11	pCi/L	Method	12/10/98	cbr	M9310	12/11/98	cbr
			Gross Beta	49	13	15	pCi/L	Method	12/10/98	cbr	M9310	12/11/98	cbr
			Radium 226, total	4.78	0.87	1.2	pCi/L	Method	12/28/98	cbr	M9315	12/29/98	cbr
			Radium 228, total	3.09	0.84	1.7	pCi/L	Method	12/16/98	ejs	M9320	12/18/98	ejs
			Thorium 230, total	0.14	0.3	0.2	pCi/L	Method	12/11/98	jd	ESM 4506	12/17/98	jd

Radiochemistry Notes

MDA: Calculated sample specific Minimum Detectable Activity

Error(+/-): Calculated sample specific uncertainty

Solid matrices reported on a dry weight basis

Preparation Method: "Method" indicates preparation defined in analytical method

Method Prefix Reference:

M = EPA SM = Standard Methods D = ASTM RP = DOE ESM = DOE/ESM

R Poulsen

Vice President of Operations: Ralph Poulsen

File Divider Page

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300. GOLDEN, COLORADO 80401 PHONE (303) 277-1687

22-May-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 3
Set : 1

Attn:
Project: Hermit Min

Received: 3-May-91 10:06

PO #:

Job: 91830E

Status: Final

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm
HER100	162	162	<1	40	7.56	2580

Sample	TDS mg/l	TSS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l
HER100	3360	17	<0.1	<0.1	2270	12.7

Sample	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l
HER100	<0.01	<0.001	0.01	579	0.009	0.01

Sample	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER100	<0.01	1.5	7.07	<0.02	191	0.09

Sample	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l
HER100	<0.0002	21.7	<0.001	75.1	<0.005

Sample	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ
HER100					3.5	±0.7

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

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22-May-91

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Attn:
Project: Hermit Min

Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

Sample Type: Water

Sample	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER100	0.0	±0.5	0.0016

BARRINGER LABORATORIES INC.
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Attn:
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Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

Abbreviations:

Parameters:

HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230

BARRINGER LABORATORIES INC.
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22-May-91

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Page: 4
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Attn:
Project: Hermit Min

Received: 3-May-91 10:06
PO #:

Job: 91830E

Status: Final

U : Uranium

Units:

mg/l : milligrams per liter
µmho/cm : micromhos per centimeter at 25C
pCi/l : picoCuries per liter
2σ : Counting error at the 95% confidence level, 2σ

Quality control:

< : less than

Signed: Lyle Ryman / Ellen La Riviere

Lyle Ryman / Ellen La Riviere
Laboratory Managers

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300. GOLDEN, COLORADO 80401 PHONE (303) 277-1687

22-May-91

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Job: 91830E

Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l
Duplicate	192	192	<1	28
Duplicate	192	192	<1	28
Duplicate % diff.	0.0	0.0	0.0	0.0
Std (actual value)	---	---	---	58
Std (expected value)	---	---	---	50
Std % diff.	---	---	---	16
Blank	---	---	---	---
Spike Recovery %	---	---	---	109

Sample Id	pH unit	Specific Conductance µmho/cm	TDS mg/l	TSS mg/l
Duplicate	7.56	---	3360	17
Duplicate	7.56	---	3360	17
Duplicate % diff.	0.0	---	0.0	0.0
Std (actual value)	---	1420	1770	---
Std (expected value)	---	1413	1742	---
Std % diff.	---	0.5	1.6	---
Blank	---	---	---	---
Spike Recovery %	---	---	---	---

Sample Id	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l
Duplicate	0.7	<0.1	2330	9.38
Duplicate	0.7	<0.1	2320	10.6
Duplicate % diff.	0.0	0.0	0.2	6.1
Std (actual value)	2.06	0.54	1300	1.23
Std (expected value)	1.98	0.50	1234	1.19

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PO #:

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Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l
Std % diff.	4	8	5.3	3.4
Blank	---	---	---	---
Spike Recovery %	112	83	---	*

Sample Id	Ag Total mg/l	As Total mg/l	Ba Total mg/l	Ca Total mg/l
Duplicate	<0.01	<0.001	<0.01	438
Duplicate	<0.01	<0.001	<0.01	510
Duplicate % diff.	0.0	0.0	0.0	7.6
Std (actual value)	1.00	0.110	1.10	237
Std (expected value)	0.97	0.100	1.02	250
Std % diff.	3.1	10	7.8	5.2
Blank	---	---	---	---
Spike Recovery %	90	76	113	94

Sample Id	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l	F mg/l
Duplicate	<0.005	<0.01	<0.01	---
Duplicate	<0.005	<0.01	<0.01	---
Duplicate % diff.	0.0	0.0	0.0	---
Std (actual value)	0.217	0.206	0.199	10.0
Std (expected value)	0.200	0.200	0.200	10.0
Std % diff.	8.5	3.0	0.5	0.0
Blank	---	---	---	---
Spike Recovery %	95	93	90	90

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QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
Duplicate	4.18	<0.02	221	0.04
Duplicate	4.96	<0.02	258	0.04
Duplicate % diff.	8.5	0.0	7.1	0.0
Std (actual value)	0.184	0.191	2.02	0.202
Std (expected value)	0.200	0.200	2.00	0.200
Std % diff.	8.0	4.5	1.0	1.0
Blank	---	---	---	---
Spike Recovery %	92	75	97	89

Sample Id	Hg Total mg/l	K Total mg/l	Se Total mg/l	Na Total mg/l
Duplicate	<0.0002	25.8	<0.001	189
Duplicate	<0.0002	31.2	<0.001	226
Duplicate % diff.	0.0	9.5	0.0	8.9
Std (actual value)	0.0049	11.3	22	240
Std (expected value)	0.0050	10.6	25	250
Std % diff.	2.0	6.6	12	4.0
Blank	---	---	---	---
Spike Recovery %	116	105	76	102

Sample Id	Zn Total mg/l	Gross Alpha Error Total pCi/l	2σ	Gross Beta Error Total pCi/l	2σ
Duplicate	0.014	0	±28	27	±18
Duplicate	0.014	5	±28	29	±18
Duplicate % diff.	0.0	100	---	3.6	---
Std (actual value)	0.193	202	±5	104	±2
Std (expected value)	0.200	206	---	106	---

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22-May-91

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Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ
Std % diff.	3.5	1.9	---	1.9	---
Blank	---	0.0	±0.2	0.4	±0.4
Spike Recovery %	88	---	---	---	---

Sample Id	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
Duplicate	22	±3	0.0	±0.5	0.0021
Duplicate	22	±3	0.0	±0.6	0.0020
Duplicate % diff.	0.0	---	0.0	---	2.4
Std (actual value)	105	±4	101	±3	33
Std (expected value)	101	---	98	---	34
Std % diff.	4.0	---	3.1	---	2.9
Blank	0.0	±0.2	0.0	±0.2	<0.0003
Spike Recovery %	---	---	---	---	---

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22-May-91

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Status: Final

QUALITY CONTROL REPORT

Abbreviations:

Parameters:

HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
Ra-226	: Radium-226

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PO #:

Job: 91830E

Status: Final

QUALITY CONTROL REPORT

Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ	: Counting error at the 95% confidence level, 2σ

Quality control:

*	: Sample > 4 times spiked value.
<	: less than

Signed: Stephen A. Nelson
.....
Approved
Quality Assurance Department

BARRINGER LABORATORIES INC.
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22-May-91

Don Pilmor
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Min PO #:

Received: 3-May-91 10:06

Job: 91830E Status: Final

QUALITY CONTROL REPORT

QUALITY CONTROL DATA SHEET

Received by: ljb Via: UPS

Sample Container Type: lg cu, L cu
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Sprague	5/7
HCO3	1	210.1	1 mg/l	3	Sprague	5/7
CO3	1	210.1	1 mg/l	3	Sprague	5/7
Cl	1	325.2	1 mg/l	3	Kidwell	5/7
pH	1	210.1	.01 unit	3	Sprague	5/7
Specific	1	120.1	.001 µmho/cm	3	Ryman	5/15
TDS	1	160.1	4 mg/l	3	Swanson	5/7
TSS	1	160.2	4 mg/l	3	Swanson	5/7
NO3 as N	1	353.1	.1 mg/l	2	Anshutz	5/10
PO4	1	365.1	.1 mg/l	3	Anshutz	5/10
SO4	1	375.3	4 mg/l	3	Swanson	5/7
SiO2	1	200.7	.01 mg/l	1	Gilleland	5/16
Ag	1	200.7	.01 mg/l	1	Gilleland	5/16
As	1	206.2	.001 mg/l	1	Sprague	5/9
Ba	1	200.7	.01 mg/l	1	Gilleland	5/16
Ca	1	200.7	.01 mg/l	1	Gilleland	5/16
Cd	1	200.7	.005 mg/l	1	Gilleland	5/16
Cr	1	200.7	.01 mg/l	1	Gilleland	5/16
Cu	1	200.7	.01 mg/l	1	Gilleland	5/16
F	1	340.2	.1 mg/l	3	Pottruff	5/8
Fe	1	200.7	.01 mg/l	1	Gilleland	5/16
Pb	1	200.7	.02 mg/l	1	Gilleland	5/16

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PO #:

Job: 91830E

Status: Final

QUALITY CONTROL REPORT

Mg	1	200.7	.01 mg/l	1	Gilleland	5/16
Mn	1	200.7	.01 mg/l	1	Gilleland	5/16
Hg	1	270.2	.0002 mg/l	1	Gilleland	5/10
K	1	200.7	.5 mg/l	1	Gilleland	5/16
Se	1	270.2	.001 mg/l	1	Sprague	5/10
Na	1	200.7	.01 mg/l	1	Gilleland	5/16
Zn	1	200.7	.005 mg/l	1	Gilleland	5/16
Ra-226	4,7,14	SM-705	0.2 pCi/l	1	Seidel	5/16-5/21
Th-230	11	---	0.2 pCi/l	1	Ortiz	5/7-5/14
U	4,9,10,14	ASTMD2907	0.3 mg/l	1	Meyer	5/16-5/17

cc: Bill Almas, ENERGY FUELS NUCLEAR

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

2-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

MAY 10

Page: 1
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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm
HER094	154	154	<1	41	6.84	2440

Sample	TDS mg/l	NO3 as N mg/l	PO4 mg/l	SO4 mg/l	SiO2 mg/l	Ag Total mg/l
HER094	3250	<0.1	<0.1	2290	12.6	<0.01

Sample	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l
HER094	0.002	0.01	513	<0.005	<0.01	<0.01

Sample	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HER094	1.6	6.41	<0.02	161	0.09	<0.0002

Sample	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ
HER094	20.7	<0.002	68.6	<0.005	71	±31

Sample	Gross Beta Total pCi/l	Error 2σ	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
HER094	27	±15	2.4	±0.5	0.0	±0.4	0.0027

BARRINGER LABORATORIES INC.
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2-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

Abbreviations:

Parameters:

HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
NO3 as N	: Nitrate
PO4	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

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2-May-91

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P.O. Box 36
Fredonia, AZ 86022

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ	: Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed: Lyle Ryman / Ellen La Riviere

Lyle Ryman / Ellen La Riviere
Laboratory Managers

BARRINGER LABORATORIES INC.
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3-May-91

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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l
Duplicate	154	154	<1	41
Duplicate	154	154	<1	41
Duplicate % diff.	0.0	0.0	0.0	0.0
Std (actual value)	---	---	---	52.5
Std (expected value)	---	---	---	50
Std % diff.	---	---	---	5
Blank	---	---	---	---
Spike Recovery %	---	---	---	---

Sample Id	pH unit	Specific Conductance µmho/cm	TDS mg/l	NO3 as N mg/l
Duplicate	6.84	2443	3250	<0.1
Duplicate	6.84	2467	3130	<0.1
Duplicate % diff.	0.0	1.0	1.3	0.0
Std (actual value)	---	---	1420	1.95
Std (expected value)	---	---	1479	1.98
Std % diff.	---	---	3.9	1.5
Blank	---	---	---	---
Spike Recovery %	---	---	---	---

Sample Id	PO4 mg/l	SO4 mg/l	SiO2 mg/l	Ag Total mg/l
Duplicate	<0.1	2290	12.6	<0.01
Duplicate	<0.1	2380	12.6	<0.01
Duplicate % diff.	0.0	1.9	0.0	0.0
Std (actual value)	0.52	1054	1.14	0.97
Std (expected value)	0.50	1000	1.19	0.97

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

3-May-91

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 2
Copy: 1 of 3
Set : 1

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	PO4 mg/l	SO4 mg/l	SiO2 mg/l	Ag Total mg/l
Std % diff.	4	5.4	4.2	0.0
Blank	---	---	---	---
Spike Recovery %	---	---	*	82

Sample Id	As Total mg/l	Ba Total mg/l	Ca Total mg/l	Cd Total mg/l
Duplicate	0.002	0.01	513	<0.005
Duplicate	0.002	0.01	516	<0.005
Duplicate % diff.	0.0	0.0	0.3	0.0
Std (actual value)	0.093	1.07	1.91	0.192
Std (expected value)	0.100	1.02	2.00	0.207
Std % diff.	7.0	5.0	4.5	7.2
Blank	---	---	---	---
Spike Recovery %	---	96	*	103

Sample Id	Cr Total mg/l	Cu Total mg/l	F mg/l	Fe Total mg/l
Duplicate	<0.01	<0.01	1.6	6.41
Duplicate	<0.01	<0.01	1.6	6.42
Duplicate % diff.	0.0	0.0	0.0	0.1
Std (actual value)	0.183	0.187	10.1	0.196
Std (expected value)	0.200	0.200	10.1	0.200
Std % diff.	8.5	6.5	0.0	2.0
Blank	---	---	---	---
Spike Recovery %	97	96	100	*

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3-May-91

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Attn:
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Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
Duplicate	<0.02	161	0.09	<0.0002
Duplicate	<0.02	161	0.08	<0.0002
Duplicate % diff.	0.0	0.0	5.9	0.0
Std (actual value)	0.196	1.83	0.193	0.0050
Std (expected value)	0.200	2.00	0.200	0.0050
Std % diff.	2.0	8.5	3.5	0.0
Blank	---	---	---	---
Spike Recovery %	98	*	96	100

Sample Id	K Total mg/l	Se Total mg/l	Na Total mg/l	Zn Total mg/l
Duplicate	20.7	<0.002	68.6	<0.005
Duplicate	20.6	<0.002	68.1	<0.005
Duplicate % diff.	0.2	0.0	0.4	0.0
Std (actual value)	11.4	0.027	1.18	0.193
Std (expected value)	10.6	0.025	1.12	0.200
Std % diff.	7.5	8.0	5.4	3.5
Blank	---	---	---	---
Spike Recovery %	103	---	*	100

Sample Id	Gross Alpha Error Total pCi/l	2σ	Gross Beta Error Total pCi/l	2σ
Duplicate	28	±15	20	±8
Duplicate	25	±16	26	±9
Duplicate % diff.	5.7	---	13	---
Std (actual value)	186	±5	108	±2
Std (expected value)	206	---	106	---

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3-May-91

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QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Gross Alpha Total pCi/l	Error 2σ	Gross Beta Total pCi/l	Error 2σ
Std % diff.	9.7	---	1.9	---
Blank	0.0	±0.2	0.0	±0.3
Spike Recovery %	---	---	---	---

Sample Id	Ra-226 Total pCi/l	Error 2σ	Th-230 Total pCi/l	Error 2σ	U Total mg/l
Duplicate	2.1	±0.7	0.0	±0.6	0.438
Duplicate	2.5	±0.8	0.0	±0.6	0.438
Duplicate % diff.	8.7	---	0.0	---	0.0
Std (actual value)	95	±2	104	±3	35
Std (expected value)	101	---	98	---	34
Std % diff.	5.9	---	6.1	---	2.9
Blank	0.0	±0.1	0.0	±0.2	<0.0003
Spike Recovery %	---	---	---	---	---

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3-May-91

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Page: 5
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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Abbreviations:

Parameters:

HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
NO3 as N	: Nitrate
PO4	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230

BARRINGER LABORATORIES INC.
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3-May-91

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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

U : Uranium

Units:

mg/l : milligrams per liter
µmho/cm : micromhos per centimeter at 25C
pCi/l : picoCuries per liter
2σ : Counting error at the 95% confidence level, 2σ

Quality control:

* : Sample > 4 times spiked value.
< : less than

Signed: .....Stephen A. Wilson.....
Approved
Quality Assurance Department

BARRINGER LABORATORIES INC.
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3-May-91

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Page: 7
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Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

QUALITY CONTROL DATA SHEET

Received by: gr Via: UPS

Sample Container Type: lg cu, L cu
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Sprague	4/12
HCO3	1	210.1	1 mg/l	3	Sprague	4/12
CO3	1	210.1	1 mg/l	3	Sprague	4/12
Cl	1	325.2	1 mg/l	3	Anshutz	4/23
pH	1	210.1	.01 unit	3	Sprague	4/12
Specific	1	120.1	.001 µmho/cm	3	Anshutz	4/29
TDS	1	160.1	4 mg/l	3	Sprague	4/17
NO3 as N	1	353.1	.1 mg/l	2	Anshutz	4/16
PO4	1	365.1	.1 mg/l	3	Anshutz	4/9
SO4	1	375.3	4 mg/l	3	Sprague	4/17
SiO2	1	200.7	.01 mg/l	1	Hidalgo	4/10
Ag	1	200.7	.01 mg/l	1	Hidalgo	4/10
As	1	206.2	.001 mg/l	1	Gilleland	4/8
Ba	1	200.7	.01 mg/l	1	Hidalgo	4/10
Ca	1	200.7	.01 mg/l	1	Hidalgo	4/10
Cd	1	200.7	.005 mg/l	1	Hidalgo	4/10
Cr	1	200.7	.01 mg/l	1	Hidalgo	4/10
Cu	1	200.7	.01 mg/l	1	Hidalgo	4/10
F	1	340.2	.1 mg/l	3	Sprague	4/10
Fe	1	200.7	.01 mg/l	1	Hidalgo	4/10
Pb	1	200.7	.02 mg/l	1	Hidalgo	4/10
Mg	1	200.7	.01 mg/l	1	Hidalgo	4/10

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300, GOLDEN, COLORADO 80401 PHONE (303) 277-1687

3-May-91

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Fredonia, AZ 86022

Attn:
Project: Hermit Mine Water PO #:

Received: 5-Apr-91 09:07

Job: 91654E Status: Final

QUALITY CONTROL REPORT

Mn	1	200.7	.01	mg/l	1	Hidalgo	4/10
Hg	1	245.1	.0002	mg/l	1	Gilleland	4/10
K	1	200.7	.5	mg/l	1	Hidalgo	4/10
Se	1	270.2	.001	mg/l	1	Gilleland	4/8
Na	1	200.7	.01	mg/l	1	Hidalgo	4/10
Zn	1	200.7	.005	mg/l	1	Hidalgo	4/10
Gross Alph	4	900.0	1.0	pCi/l	1	Seidel	4/11-4/18
Gross Beta	4	900.0	2.0	pCi/l	1	Seidel	4/11-4/18
Ra-226	4,7,14	SM-705	0.2	pCi/l	1	Howard	4/21-4/26
Th-230	11	---	0.2	pCi/l	1	Ortiz	4/10-4/16
U	4,9,10,14	ASTMD2907	0.3	mg/l	1	Meyer	4/29

cc: Bill Almas, ENERGY FUELS NUCLEAR

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

https://www.astm.org/d2907-97.html

BARRINGER LABORATORIES INC.
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PHONE: (303) 277-1687

1-Feb-91

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

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PO #:

Job: 903500E Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	CO3 as CaCO3 mg/l	HCO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l
HER073	161	<1	161	40	7.38	3470	3380

Sample	TSS mg/l	NO3 as N mg/l	PO4 as P mg/l	SO4 mg/l	SiO2 mg/l	As Total mg/l	Ba Total mg/l
HER073	<4	<0.1	<0.1	1830	13.0	0.002	0.01

Sample	Ca Total mg/l	Cd Total mg/l	Cr Total mg/l	Cu Total mg/l	F mg/l	Fe Total mg/l
HER073	525	<0.005	<0.01	<0.01	1.5	9.47

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1-Feb-91

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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 26-Oct-90 15:23

Job: 903500E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	K Total mg/l	Ag Total mg/l
HER073	<0.02	177	0.12	<0.0002	20.1	0.01

Sample	Se Total mg/l	Na Total mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HER073	<0.002	78.1	0.111	58	±26

BARRINGER LABORATORIES INC.
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1-Feb-91

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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: PO #:

Received: 26-Oct-90 15:23

Job: 903500E Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Ra-228 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*
HER073	48	±14	3.2	±0.6	1.5	±1.3	0.0	±0.5

Sample	U Total mg/l
HER073	0.0009

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

https://www.astm.org/d2907-97.html

BARRINGER LABORATORIES INC.
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1-Feb-91

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Denver, CO 80202

Attn:
Project: PO #:

Received: 26-Oct-90 15:23

Job: 903500E Status: Final

AMENDED REPORT

Abbreviations:

Parameters:

CO3	: Carbonate
HCO3	: Bicarbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4 as P	: Phosphate
SO4	: Sulfate
SiO2	: Silica
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Ag	: Silver
Se	: Selenium
Na	: Sodium
Zn	: Zinc

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Attn:
Project: PO #:

Received: 26-Oct-90 15:23

Job: 903500E Status: Final

AMENDED REPORT

Ra-226	: Radium-226
Ra-228	: Radium-228
Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than
a	: Amended Value

Signed: Lyle Ryman / Ellen La Riviere

Lyle Ryman / Ellen La Riviere
Laboratory Managers

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
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1-Feb-91

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1200 17th Street
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Denver, CO 80202

Attn:
Project:
PO #:

Received: 26-Oct-90 15:23

Job: 903500E
Status: Final

AMENDED REPORT

QUALITY CONTROL DATA SHEET

Time Received: 15:23 Date: 10/26/90 Via: Federal Express

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Received: 1. HN03 2. H2SO4 3. none
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
As	1	206.2	0.001 mg/l	1	Gilleland	11/19
Hg	1	245.1	0.0002 mg/l	1	Anshutz	11/19
Se	1	270.2	0.002 mg/l	1	Gilleland	11/21
pH	1	150.1	0.01 unit	3	Hobbs	11/15
Cl	1	325.2	1 mg/l	3	Hobbs	10/31
Alk	1	210.1	1 mg/l	3	Hobbs	11/16
Sp. Cond.	1	1201	0.001 mg/l	3	Anshutz	11/19
F	1	340.2	0.1 mg/l	3	Anshutz	11/20
Ag	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Ba	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Ca	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Cd	1	200.7	0.005 mg/l	3	Hidalgo	11/21
Cr	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Cu	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Fe	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Pb	1	200.7	0.02 mg/l	1	Hidalgo	11/21

BARRINGER LABORATORIES INC.
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1-Feb-91

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Attn:
Project: PO #:

Received: 26-Oct-90 15:23

Job: 903500E Status: Final

AMENDED REPORT

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Ref	Method	LLD	Preservative	Analysis	Date(s) of Analysis
Mg	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Mn	1	200.7	0.01 mg/l	1	Hidalgo	11/21
K	1	200.7	0.5 mg/l	1	Hidalgo	11/21
Na	1	200.7	0.01 mg/l	1	Hidalgo	11/21
Zn	1	200.7	0.005 mg/l	1	Hidalgo	11/21
SiO2	1	200.7	0.01 mg/l	1	Hidalgo	11/21
PO4	1	365.1	0.1 mg/l	3	Hobbs	11/1
NO3	1	353.1	0.1 mg/l	2	Hobbs	11/5
SO4	1	375.3	4 mg/l	3	Joy	11/10
TDS	1	160.1	4 mg/l	3	Joy	11/9
TSS	1	160.2	4 mg/l	3	Joy	11/10
Gr. Alpha	4	900.0	1.0 pCi/l	1	Seidel	11/19-11/21
Gr. Beta	4	900.0	2.0 pCi/l	1	Seidel	11/19-11/21
Ra-226	4,7,14	SM-705	0.2 pCi/l	1	Howard	11/15-11/19
Ra-228	12,13,14	904.0	0.9 pCi/l	1	Reyes	11/8-11/19
Th-230	11	---	0.2 pCi/l	1	Ortiz	11/6-11/13
U	4,9,10,14	ASTMD2907	0.3 µg/l	1	Tonning	11/12-11/14
Gr. Alpha(a)	4	900.0	1.0 pCi/l	1	Kidwell	1/22-1/25
Gr. Beta(a)	4	900.0	2.0 pCi/l	1	Kidwell	1/22-1/25

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

https://www.astm.org/d2907-97.html

BARRINGER LABORATORIES INC.

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PHONE 303 277 1687

1655 DEMING WAY, SUITE 15
SPARKS NEVADA 89431
PHONE 702 358 1158

24-Oct-90

Bill Almas
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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

Sample Type: Water

Sample Id	Ag Dissolved mg/l	As Dissolved mg/l	Ba Dissolved mg/l	Ca Dissolved mg/l	Cd Dissolved mg/l
HER069 7/31/90	<0.01	0.001	<0.01005	632	<0.005

Sample Id	Cr Total mg/l	Cu Dissolved mg/l	F Dissolved mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l
HER069 7/31/90	<0.01	<0.01	1.5	12.7	<0.02

Sample Id	Mg Dissolved mg/l	Mn Dissolved mg/l	Hg Dissolved mg/l	K Dissolved mg/l	Se Dissolved mg/l
HER069 7/31/90	211	0.17	<0.0002	22.7	0.002

Sample Id	Na Dissolved mg/l	Zn Dissolved mg/l	Alkalinity as CaCO3 mg/l	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l
HER069 7/31/90	82.6	<0.005	152	152	<0.1	39.

Sample Id	pH unit	Conductance µmho/cm	TDS mg/l	TSS mg/l	NO3 as N mg/l	PO4 as P mg/l
HER069 7/31/90	7.28	3261	3540	67	<0.1	0.2

BARRINGER LABORATORIES INC.

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PHONE (702) 358-1158

24-Oct-90

Bill Almas
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1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

Sample Type: Water

Sample Id	SO4 mg/l	SiO2 Dissolved mg/l	Gross Alpha Error Dissolved pCi/l	2σ*	Gross Beta Error Dissolved pCi/l	2σ*
HER069 7/31/90	2250	14.3	1	±18	29	±15

Sample Id	Gross Alpha Error Total pCi/l	2σ*	Gross Beta Error Total pCi/l	2σ*	Ra-226 Error Dissolved pCi/l	2σ*
HER069 7/31/90	14	±20	13	±13	3.1	±0.9

Sample Id	Ra-226 Error Total pCi/l	2σ*	Th-230 Error Dissolved pCi/l	2σ*	Th-230 Error Total pCi/l	2σ*	U Dissolved mg/l
HER069 7/31/90	5.2	±1.1	0.0	±0.4	0.9	±0.7	0.0009

Sample Id	U Total mg/l
HER069 7/31/90	0.0042

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PHONE: (702) 358-1158

24-Oct-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

Abbreviations:

Parameters:

Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4 as P	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ra-226	: Radium-226

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Attn:
Received: 7-Aug-90 12:51
Project: Hermit Mine Well PO #:

Job: 902938E Status: Final

Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed: Ellen La Riviere

Ellen La Riviere
Radiochemistry Laboratory Manager

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Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 7/12/90 Date: Receiving By: UPS Via:

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Received: 1. HN03 2. H2S04 3. none 4. NaOH/ZnoAC
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Cl	1	325.2	1 mg/l	3	Hobbs	8/9
Hg	1	245.1	0.0002 mg/l	1	Anshutz	8/9
pH	1	210.1	0.01 unit	3	Anshutz	8/13
Sp. Cond.	1	12011	0.001 mg/l	3	Anshutz	8/17
F	1	340.2	0.05 mg/l	3	Ryman	8/23
Ba	1	200.7	0.01 mg/l	1	Hidalgo	8/27
Cd	1	200.7	0.005 mg/l	3	Hidalgo	8/27
Ca	1	200.7	0.01 mg/l	1	Hidalgo	8/27
Cr	1	200.7	0.01 mg/l	1	Hidalgo	8/28
Cu	1	200.7	0.01 mg/l	1	Hidalgo	8/29
Fe	1	200.7	0.01 mg/l	1	Hidalgo	8/29
Pb	1	200.7	0.001 mg/l	1	Hidalgo	8/29
Mg	1	200.7	0.01 mg/l	1	Hidalgo	8/29
Mn	1	200.7	0.01 mg/l	1	Hidalgo	8/29
K	1	200.7	0.5 mg/l	1	Hidalgo	8/29
Ag	1	200.7	0.01 mg/l	1	Hidalgo	8/29
Na	1	200.7	0.01 mg/l	1	Hidalgo	8/29

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Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

CONTROL DATA SHEET (cont'd)

Parameter	Ref	Method	LLD	Preservativ	Analysis	Date(s) of Analysis
Zn	1	200.7	0.005 mg/l	1	Hidalgo	8/29
Se	1	270.2	0.001 mg/l	1	Gilleland	8/29
SiO2	1	---	0.01 mg/l	1	Hidalgo	8/29
As	1	206.2	0.001 mg/l	1	Ryman	8/15
Alk	1	210.1	1 mg/l	3	Anshutz	8/30
NO3	1	353.1	0.1 mg/l	2	Hobbs	8/9
TSS	1	160.2	4 mg/l	3	Anshutz	8/9
PO4	1	365.1	0.1 mg/l	3	Hobbs	8/15
SO4	1	375.3	4 mg/l	3	Joy	8/22
TDS	1	160.1	10 mg/l	3	Joy	8/23
Gr. Alpha	4	900.0	1.0 pCi/l	3	Seidel	8/13-8/16
Gr. Beta	4	900.0	2.0 pCi/l	3	Seidel	8/13-8/16
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	8/24-8/28
Th-230	11	---	0.2 pCi/l	3	Ortiz	8/22-8/27
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Tonning	8/28-8/31

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

https://www.astm.org/d2907-97.html

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Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HERO69 7/31/90	Cl	39.6	39.6	0
" "	Hg	<.0002	<.0002	0
" "	Sp. Cond.	3261	3261	0
" "	F	1.5	1.5	0
" "	Ba	.01	.01	0
" "	Cd	<.005	.008	(1)
" "	Ca	632	616	1.3
" "	Cr	<.01	<.01	0
" "	Cu	<.01	<.01	0
" "	Fe	12.7	12.2	2.0
" "	Pb	<.02	<.02	0
" "	Mg	211	199	2.9
" "	Mn	.17	.17	0
" "	K	22.7	21.1	2.8
" "	Ag	<.01	<.01	0
" "	Na	82.6	76.7	3.7
" "	Zn	<.005	<.005	0
" "	Se	.002	<.002	(1)
" "	SiO2	14.3	13.9	1.4
" "	As	.001	.001	0
" "	Alk	150.2	153.3	1.0
" "	NO3	<.1	<.1	0
" "	TSS	68	66	1.5
" "	PO4	.19	.19	0
" "	SO4	2260	2230	0.7
" "	TDS	3540	3540	0

(1) sample < 5 times LLD

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Attn:
Project: Hermit Mine Well PO #:

Received: 7-Aug-90 12:51

Job: 902938E Status: Final

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Cl	52.9	52.1	48.2 - 55.4	0.8	---
Hg	.0086	.0080	.0060 - .0093	3.6	110
F	1.05	1.08	.99 - 1.15	1.4	97
Ba	1.02	1.00	.90 - 1.10	2.0	87
Cd	.218	.200	.180 - .220	9.0	108
Ca	2.04	2.00	1.80 - 2.20	2.0	(2)
Cr. Cond.	.193	.200	.180 - .220	3.5	90
Cu	.202	.200	.180 - .220	1.0	97
Fe	.215	.200	.180 - .220	7.5	(2)
Pb	.211	.200	.180 - .220	5.5	84
Mg	2.14	2.00	1.80 - 2.20	7.0	(2)
Mn	.212	.200	.180 - .220	6.0	92
K	10.2	10.0	9.0 - 11.0	2.0	(2)
Ag	.99	1.00	.90 - 1.10	1.0	92
Na	1.10	1.00	.90 - 1.10	10.0	(2)
Zn	.199	.200	.180 - .220	0.5	86
Se	.010	.009	.006 - .012	11.1	---
SiO2	1.12	1.07	.96 - 1.18	5.0	(2)
As	.103	.100	.080 - .118	1.5	100
NO3	2.02	1.98	1.78 - 2.18	1.0	80
PO4	.51	.50	.46 - .54	1.0	---
SO4	1035.3	1000	900 - 1100	1.8	---
TDS	1460	1479	1331 - 1627	.65	---
Gr. Alpha	197 ± 4	196	176 - 216	0.5	---
Gr. Beta	179 ± 2	173	156 - 190	3.5	---
Ra-226	97 ± 2	101	91 - 111	4.0	---
Th-230	92 ± 3	98	88 - 108	6.1	---
U	33	34	31 - 37	2.9	---

(2) sample > 4 times spiked value

Approved by: Ellen LaRivière

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24-Oct-90

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Page: 1
Copy: 2 of 3
Set : 1

Attn:
Project: PO #:

Received: 18-May-90 15:35

Job: 902490E Status: Final

Sample Type: Water

Sample	Ag Dissolved mg/l	As Dissolved mg/l	Ba Dissolved mg/l	Ca Dissolved mg/l	Cd Dissolved mg/l	Cr Total mg/l
HER064	<0.01	<0.001	0.01	610	0.007	<0.01

Sample	Cu Dissolved mg/l	F mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l	Mg Dissolved mg/l	Mn Dissolved mg/l
HER064	<0.01	1.4	13.2	<0.02	186	0.18

Sample	Hg Dissolved mg/l	K Dissolved mg/l	Se Dissolved mg/l	Na Dissolved mg/l	Zn Dissolved mg/l	Alkalinity as CaCO3 mg/l
HER064	<0.0002	22.5	<0.001	82.6	<0.005	170

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l	TSS mg/l
HER064	170	<1	41	8.06	3318	3320	93

Sample	NO3 as N mg/l	PO4 as P mg/l	SO4 mg/l	SiO2 Dissolved mg/l	Gross Alpha Error Dissolved pCi/l	2σ*
HER064	<0.1	0.3	1150	13.3	12	±14

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Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

Sample Type: Water

Sample	Gross Beta Dissolved pCi/l	Error 2σ*	Gross Alpha Total pCi/l	Error 2σ*	Gross Beta Total pCi/l	Error 2σ*
HER064	37	±12	44	±18	35	±12

Sample	Ra-226 Dissolved pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*
HER064	1.7	±0.5	2.0	±0.7	0.9	±0.6	1.0	±0.9

Sample	U Dissolved mg/l	U Total mg/l
HER064	0.001	0.008

Standard
Withdrawn, No replacement

Last Updated: Mar 02, 2021
ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

1.2 The uranium fluorescence is quenched by many cations and some anions in the sample; it is enhanced by a few cations. If interfering ions are present, a direct fluorometric measurement is not suitable, and an extraction method must be used to provide accurate results. The test methods and their concentration ranges are as follows:

Concentration Range, mg/L Sections Test Method A---Direct Fluorometric 0.005 to 2 7 to 15 Test Method B---Extraction 0.04 to 50 16 to 24
1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific hazards, see Note 1.

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Page: 3
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Received: 18-May-90 15:35

Job: 902490E

Status: Final

Abbreviations:

Parameters:

Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4 as P	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ra-226	: Radium-226

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Attn:
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Received: 18-May-90 15:35

Job: 902490E

Status: Final

Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed: Ellen La Riviere

Ellen La Riviere
Radiochemistry Laboratory Manager

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Page: 5
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Attn:
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Received: 18-May-90 15:35

Job: 902490E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 3:35 Date: 5/18/90 By: Receiving Via: UPS

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None 4. Zn/Ac
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
pH	1	150.1	.01 unit	3	Ryman	5/22
Cl	1	325.2	1 mg/l	3	Hobbs	5/25
Alk	1	210.1	1 mg/l	3	Ryman	5/22
Hg	1	245.1	.0002 mg/l	1	Gilleland	5/25
Cond.	1	1201	.001 mg/l	3	Ryman	5/31
F	1	340.2	.05 mg/l	3	Hatcher	6/4
Ag	1	200.7	.01 mg/l	1	Hidalgo	6/14
Ba	1	200.7	.01 mg/l	1	Hidalgo	6/14
Ca	1	200.7	.01 mg/l	1	Hidalgo	6/14
Cd	1	200.7	1 mg/l	1	Hidalgo	6/14
Cr	1	200.7	.01 mg/l	1	Hidalgo	6/14
Cu	1	200.7	.01 mg/l	1	Hidalgo	6/14
Fe	1	200.7	.01 mg/l	1	Hidalgo	6/14
Pb	1	200.7	.02 mg/l	1	Hidalgo	6/14
Mg	1	200.7	.01 mg/l	1	Hidalgo	6/14
Mn	1	200.7	.01 mg/l	1	Hidalgo	6/14
K	1	200.7	.5 mg/l	1	Hidalgo	6/14
Na	1	200.7	.01 mg/l	1	Hidalgo	6/14
Zn	1	200.7	.005 mg/l	1	Hidalgo	6/14
As	1	206.2	.001 mg/l	1	Gilleland	6/8
Se	1	270.2	.001 mg/l	1	Gilleland	6/11
SiO2	1	200.7	.01 mg/l	1	Hidalgo	6/14

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Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
NO3	1	353.1	.1 mg/l	2	Hobbs	5/31
TDS	1	160.1	10 mg/l	3	Hatcher	6/1
SO4	1	375.3	4 mg/l	3	Hatcher	6/1
PO4	1	365.1	.1 mg/l	3	Hobbs	6/6
TSS	1	160.2	4 mg/l	3	Hatcher	6/15
Gr. Alpha	4	900.0	1.0 pCi/l	3	Seidel	6/5-6/13
Gr. Beta	4	900.0	2.0 pCi/l	3	Seidel	6/5-6/13
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Kidwell	6/7-6/12
Th-230	11	---	0.2 pCi/l	3	Ortiz	5/31-6/8
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Tonning	6/12-6/15

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER064	Cl	40.2	40.7	1.2
"	Alk	169.7	170.0	.2
"	Hg	<.0002	<.0002	0
"	Cond.	3318	3285	1.0
"	F	1.4	1.5	6.9
"	Ag	<.01	<.01	0
"	Ba	.01	.01	0
"	Ca	610	595	2.4
"	Cd	.007	.007	0
"	Cr	<.01	<.01	0
"	Cu	<.01	<.01	0
"	Fe	13.2	12.9	2.3
"	Pb	<.02	<.02	0
"	Mg	186	181	2.7
"	Mn	.18	.18	0
"	K	22.5	22.4	0.4
"	Na	82.6	79.7	3.5

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The Spike samples for the Lab Accuracy test, which these results are copied from, were sent to the Barringer with HER 073 in October 1990

Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

DUPLICATES (Cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER064	Zn	<.005	<.005	0
"	As	<.001	<.001	0
"	Se	<.001	<.001	0
"	SiO2	13.3	13.0	2.3
"	NO3	<.1	<.1	0
"	TDS	3324	3418	2.8
"	SO4	1154	1163	.8
"	PO4	.3	.3	0
"	TSS	93	98	5.2

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Cl	52	52.1	48.2 - 55.4	.2	---
Hg	.006	.005	.004 - .006	17	112
Cond.	1413	1413	-----	0	---
F	1.0	1.0	.89 - 1.09	0	---
Ag	1.02	1.00	.90 - 1.10	2.0	93
Ba	1.08	1.60	.90 - 1.10	8.0	89
Ca	248	250	225 - 275	0.8	---
Cd	.216	.200	.180 - .220	8.0	99
Cr	.209	.200	.180 - .220	4.5	102
Cu	.197	.200	.180 - .220	1.5	88
Fe	.215	.200	.180 - .220	7.5	---
Pb	.219	.200	.180 - .220	9.5	103
Mg	230	250	225 - 275	8.0	---
Mn	.209	.200	.180 - .220	4.5	85
K	9.5	10.0	9.0 - 11.0	5.0	---
Na	262	250	225 - 275	4.8	---
Zn	.205	.200	.180 - .220	2.5	89
As	.095	.100	.080 - .118	5	---

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24-Oct-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

QUALITY CONTROL STANDARDS (Cont'd)

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Se	.020	.025	.017 - .028	22	---
SiO2	1.00	1.07	.96 - 1.18	7.0	---
NO3	2.03	1.98	1.78 - 2.18	2.5	---
TDS	1464	1479	1331 - 1627	1.0	---
SO4	1046	1000	900 - 1100	4.5	---
PO4	.54	.50	.46 - .54	7.7	---
Gr. Alpha	190 ± 4	196	176 - 216	3.1	---
Gr. Beta	184 ± 2	173	156 - 190	6.4	---
Ra-226	109 ± 3	101	91 - 111	1.8	---
Th-230	96 ± 3	98	88 - 108	2.0	---
U	34	34	31 - 37	0	---

Approved by: Ellen LaRuine

The Spike samples for the Lab Accuracy test, which these results are copied from, were sent to the Barringer with HER 073 in October 1990

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

17-May-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 2-Apr-90 16:37

Job: 902181E

Status: Final

Sample	Alkalinity as CaCO3 mg/l	As Dissolved mg/l	Ba Dissolved mg/l	HCO3 as CaCO3 mg/l	Cd Dissolved mg/l	Ca Dissolved mg/l
HER061	149	0.003	0.03	149	0.009	609

Sample	Cl mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Dissolved mg/l	F mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l
HER061	38	<0.01	3330	0.04	1.4	13.5	0.02

Sample	Mg Dissolved mg/l	Mn Dissolved mg/l	Hg Dissolved mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l
HER061	186	0.22	0.0003	<0.1	6.98	0.2

Sample	K Dissolved mg/l	Se Dissolved mg/l	SiO2 Dissolved mg/l	Ag Dissolved mg/l	Na Dissolved mg/l	TDS mg/l
HER061	24.2	<0.001	13.6	0.01	72.6	3430

Sample	TSS mg/l	SO4 mg/l	Zn Dissolved mg/l	Gross Alpha Error Dissolved pCi/l	2σ*	Gross Beta Error Dissolved pCi/l	2σ*
HER061	59	2290	0.028	23	±18	21	±10

Sample	Gross Alpha Error Total pCi/l	2σ*	Gross Beta Error Total pCi/l	2σ*	Ra-226 Dissolved pCi/l	Error 2σ*
HER061	21	±19	40	±11	33	±2

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17-May-90

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Attn:
Project:

Received: 2-Apr-90 16:37
PO #:

Job: 902181E Status: Final

Sample	Ra-226 Total pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Dissolved mg/l	U Total mg/l
HER061	36	±2	0.0	±0.3	0.0	±0.4	0.0005	0.0036

Sample	CO3 as CaCO3 mg/l
HER061	<1

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17-May-90

Bill Almas
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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Page: 3
Copy: 3 of 3
Set : 1

Attn:
Project:

Received: 2-Apr-90 16:37
PO #:

Job: 902181E

Status: Final

Abbreviations:

Parameters:

As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium
CO3	: Carbonate

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17-May-90

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Denver, CO 80202

Page: 4
Copy: 3 of 3
Set : 1

Attn:
Project:

Received: 2-Apr-90 16:37

PO #:

Job: 902181E

Status: Final

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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17-May-90

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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 2-Apr-90 16:37

Job: 902181E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 8:30 Date: 4/2/90 By: Receiving Via: UPS

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Receivied: 1. HNO3 2. H2SO4 3. None 4. NaOH/ZnAc
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Cl	1	325.2	1 mg/l	3	Hobbs	4/5
NO3	1	353.1	.1 mg/l	2	Hobbs	4/4
pH	1	150.1	.01 mg/l	3	Hatcher	4/4
Alk	1	210.1	1 mg/l	3	Hatcher	4/6
F	1	340.2	.05 mg/l	3	Ryman	4/6
PO4	1	365.1	.1 mg/l	3	Hobbs	4/6
Cond.	1	1201	.001 mg/l	3	Ryman	4/23
As	1	206.2	.001 mg/l	1	Gilleland	4/23
Hg	1	245.1	.0002 mg/l	1	Swanson	4/23
Se	1	270.2	.001 mg/l	1	Gilleland	4/24
Cl	1	200.7	1 mg/l	3	Hidalgo	4/30
Ba	1	200.7	.01 mg/l	1	Hidalgo	4/30
Cd	1	200.7	.005 mg/l	1	Hidalgo	4/30
Ca	1	200.7	.01 mg/l	1	Hidalgo	4/30
Cu	1	200.7	.01 mg/l	1	Hidalgo	4/30
Fe	1	200.7	.01 mg/l	1	Hidalgo	4/30
Pb	1	200.7	.02 mg/l	1	Hidalgo	4/30
Mg	1	200.7	.01 mg/l	1	Hidalgo	4/30
Mn	1	200.7	.01 mg/l	1	Hidalgo	4/30
K	1	200.7	.5 mg/l	1	Hidalgo	4/30
Ag	1	200.7	.01 mg/l	1	Hidalgo	4/30
Na	1	200.7	.01 mg/l	1	Hidalgo	4/30

BARRINGER LABORATORIES INC.

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17-May-90

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One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 2-Apr-90 16:37

Job: 902181E

Status: Final

QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Zn	1	200.7	.005 mg/l	1	Hidalgo	4/30
TDS	1	160.1	10 mg/l	3	Hatcher	4/5
TSS	1	160.2	4 mg/l	3	Hatcher	4/4
SO4	1	375.3	4 mg/l	3	Hatcher	4/6
SiO2	1	200.7	.01 mg/l	1	Hidalgo	4/30
Gr. Alpha	4	900.0	1.0 pCi/l	3	Kidwell	4/4-4/16
Gr. Beta	4	900.0	2.0 pCi/l	3	Kidwell	4/4-4/16
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	5/7-5/9
Th-230	11	---	0.2 pCi/l	3	Ortiz	4/3-4/5
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Tonning	4/26-5/3

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

When received?
Sample Date 10/19/89?
This is the "2nd Quarter Confirmation Sample"

See septic tank sample from 10/2/89 for R/M groundwater chemistry

Authority:
Project :

Purchase order :

Job: 891358E Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	As Total mg/l	Ba Total mg/l	CO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l
HER 051	150	0.022	0.01	<1	<0.005	547	39	0.01

Sample	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER 051	3600	<0.01	1.43	4.71	<0.02	201	0.39

Sample	Hg Total mg/l	NO3 as N mg/l	PO4 as P Total mg/l	K Total mg/l	Se Total mg/l	SiO2 mg/l	Ag Total mg/l	Na Total mg/l
HER 051	<0.0002	<0.1	<0.1	31.6	0.023	9.8	<0.01	102

Sample	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*	Gross Beta Total pCi/l	Error 2σ*
HER 051	3220	2280	0.013	78	±21	54	±16

Sample	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HER 051	0.8	±0.3	0.0	±0.4	0.0064

BARRINGER LABORATORIES INC.

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

Abbreviations:

Analyses:

HCO3	: Bicarbonate
As	: Arsenic
Ba	: Barium
CO3	: Carbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....
David Lasher
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: Date: 10/20/89 By: T.Moncrief Via: Hand Deliv.

Sample Container Type: small cube, large cube, glass bottle
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH/Zn acetate
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
HCO3	1	210.1	1 mg/l	3	Swanson	11/8
As	1	206.2	0.001 mg/l	1	Gilleland	10/31
Ba	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Cd	1	200.7	0.005 mg/l	1	Hidalgo	11/14
Ca	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Cl	1	325.2	1 mg/l	3	Hobbs	10/25
Cr	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/30
Cu	1	200.7	0.01 mg/l	1	Hidalgo	11/14
F	1	340.2	0.05 mg/l	3	Acree	10/31
Fe	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Pb	1	200.7	0.02 mg/l	1	Hidalgo	11/14
Mg	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Mn	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Hg	1	245.1	0.0002 mg/l	1	Swanson	10/26
NO3	1	353.1	0.1 mg/l	2	Hobbs	10/24
PO4	1	365.1	0.1 mg/l	3	Hobbs	11/9
K	1	200.7	0.5 mg/l	1	Hidalgo	11/14
Se	1	270.2	0.001 mg/l	1	Swanson	11/6
SiO2	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Ag	1	200.7	0.01 mg/l	1	Hidalgo	11/14
Na	1	200.7	0.01 mg/l	1	Hidalgo	11/14

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8-Dec-89

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Fredonia, AZ 86022

Authority:
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Purchase order :

Job: 891358E Status: Final

TDS	1	160.1	10	mg/l	3	Acree	10/26
SO4	1	375.3	5	mg/l	3	Acree	10/25
Zn	1	200.7	0.005	mg/l	1	Hidalgo	11/14
Gr.Alpha	4	900.0	1.0	pCi/l	3	Seidel	11/27-12/5
Gr.Beta	4	900.0	2.0	pCi/l	3	Seidel	11/27-12/5
Ra-226	4,7,14	SM 705	0.2	pCi/l	3	Howard	11/13-11/16
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/15-11/22
U	4,9,10,14	ASTM D2907	0.3	µg/l	3	Krizman	10/25-10/27

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER 051	HCO3	150.2	149.2	0.6
HER 051	As	.020	.021	5
HER 051	Ba	.01	.01	0.0
HER 051	Cd	<.005	<.005	0.0
HER 051	Cl	39	39	0.0
HER 051	Cr	.01	.01	0.0
HER 051	Sp.Cond.	3601	3601	0.0
HER 051	Cu	<.01	<.01	0.0
HER 051	F	1.43	1.46	2.1
HER 051	Fe	4.71	4.82	2.3
HER 051	Pb	<.02	<.02	0.0
HER 051	Mg	201	206	2.5
HER 051	Mn	.39	.39	0.0
HER 051	Hg	<.0002	<.0002	0.0
HER 051	NO3	<.1	<.1	0.0
HER 051	PO4	<.1	<.1	0.0
HER 051	K	31.6	32.1	1.5
HER 051	Se	.026	.026	0.0
HER 051	SiO2	9.8	10.0	2
HER 051	Ag	<.01	<.01	0.0
HER 051	Na	102	104	2.0
HER 051	Zn	.013	.015	---
HER 051	U	.0064	.0063	0.8

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8-Dec-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891358E

Status: Final

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
As	.100	.100	.080 - .118	0.0	---
Ba	1.03	.97	.87 - 1.07	6.0	102
Cd	.193	.200	.180 - .220	3.5	102
Ca	2.04	2.00	1.80 - 2.20	2.0	---
Cl	24.7	26.05	24.1 - 27.7	5.3	---
Cr	.197	.200	.180 - .220	1.5	95
Sp.Cond.	1413	1413	---	0.0	---
Cu	.214	.200	.180 - .220	7.0	94
F	.50	.50	.45 - .55	0.0	82
Fe	.213	.200	.180 -.220	6.5	---
Pb	.217	.200	.180 -.220	8.5	103
Mg	2.19	2.00	1.80 - 2.20	9.5	---
Mn	.204	.200	.180 - .220	2.0	105
Hg	.005	.005	.004 - .006	0.0	100
NO3	2.03	1.98	1.78 - 2.18	2.5	72
PO4	.51	.50	.46 - .54	2.0	---
K	10.2	10.0	9.0 - 11.0	2.0	102
Se	.025	.025	.017 - .028	0.0	---
SiO2	1.05	1.07	.96 - 1.18	2	99
Ag	.92	.99	.89 - 1.09	7	90
Na	.94	.86	.76 - .96	8.0	---
TDS	1390	1479	1331 - 1627	6.2	---
SO4	1033	1000	900 - 1100	3.2	---
Zn	.199	.200	.180 - .220	0.5	97
Gr.Alpha	177 ± 4	198	178 - 218	10.6	---
Gr.Beta	163 ± 2	179	161 - 197	8.9	---
Ra-226	104 ± 3	101	96 - 106	3.0	---
Th-230	103 ± 3	99	94 - 104	4.0	---
U	36	34	32 - 36	5.9	--

Approved by: _____

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: L. Casebolt

Client No. Log No. 633 Client PO No.

Sample Type: water

Date Collected: 6/29/89 Date Received: 7/7/89 Date Reported: 8/3/89

RESULTS OF ANALYSIS

Sample Identification	As Total mg/l	Ba Total mg/l	Cd Total mg/l	Cu Total mg/l	Fe Total mg/l	Pb Total mg/l	Mn Total mg/l
HER044	.004	.02	.006	.02	12.0	<.02	.23

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	Se Total mg/l	Ag Total mg/l	Zn Total mg/l
HER044	<.0002	.3	.020	<.01	.077

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER044	28 ± 21	40 ± 11	0.0035

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 633

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 7/7/89 By: Gina Reichert Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Arsenic	1	206.2	1 ug/1	1	G. Gilliland	7/19/89
Selenium	1	270.2	1 ug/1	1	G. Gilleland	7/19/89
Nitrate	1	353.1	0.1 mg/1	2	D. Hobbs	7/20/89
Mercury	1	245.1	0.2 ug/1	1	M. Swanson	7/20/89
Barium	1	200.7	10 ug/1	1	D. Hidalgo	7/20/89
Cadmium	1	200.7	5 ug/1	1	D. Hidalgo	7/20/89
Copper	1	200.7	10 ug/1	1	D. Hidlago	7/20/89
Iron	1	200.7	10 ug/1	1	D. Hidalgo	7/20/89
Lead	1	200.7	2 ug/1	1	D. Hidalgo	7/20/89
Manganese	1	200.7	1 ug/1	1	D. Hidalgo	7/20/89
Silver	1	200.7	10 ug/1	1	D. Hidalgo	7/20/89
Zinc	1	200.7	5 ug/1	1	D. Hidalgo	7/20/89
Alpha-Beta	4		1.0,2.0 pCi/1	3	M. Kidwell	7/19-7/31/89
Uranium	4,14		0.3 ug/1	3	B. Tonning	7/26-7/29/89

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER044	Arsenic	.004	.005	20.0%
HER044	Selenium	.019	.019	0.0%
HER044	Nitrate	.3	.3	0.0%
HER044	Mercury	<.0002	<.0002	0.0%
HER044	Barium	.02	.02	0.0%

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 633

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER044	Cadmium	.006	<.005	---
HER044	Copper	.02	.02	0.0%
HER044	Iron	12.0	11.9	0.8%
HER044	Lead	<.02	<.02	0.0%
HER044	Manganese	.23	.23	0.0%
HER044	Silver	<.01	<.01	0.0%
HER044	Zinc	.077	.074	3.9%
HER044	Gross Alpha	13 ± 19	42 ± 23	54.0%
HER044	Gross Beta	39 ± 11	42 ± 11	3.7%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Target Range	Relative Deviation From Known	Spike % Recovery
Arsenic	.062	.062	.048 - .073	0.0%	100
Selenium	.009	.009	.006 - .012	0.0%	---
Nitrate	2.08	1.98	1.78 - 2.18	4.9%	101
Mercury	.005	.005	.004 - .006	0.0%	100
Barium	.96	.97	.87 - 1.07	1.0%	97
Cadmium	.212	.200	.180 - .220	6.0%	98
Copper	.205	.200	.180 - .220	2.5%	104
Iron	.219	.200	.180 - .220	9.5%	---
Lead	.181	.200	.180 - .220	9.5%	97
Manganese	.207	.200	.180 - .220	3.5%	106
Silver	.90	.99	.89 - 1.09	9.0%	90
Zinc	.203	.200	.180 - .220	1.5%	115
Gross Alpha	216 ± 4	198	178 - 218	9.1%	---
Gross Beta	175 ± 2	179	161 - 197	2.2%	---
Uranium	33	34	32 - 36	2.9%	---

Approved by Barbara Copp

BARRINGER LABORATORIES INC.

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GOLDEN, COLORADO 80401
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1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

16-Feb-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 1 of 3
Set : 1

Attn:
Project:

Received: 8-Feb-90
Purchase order :

Job: 901940E

Status: Final

ADDITIONAL ANALYSIS

Sample Type: Water

Sample	Gross Alpha Dissolved pCi/l	Error 2σ*	Gross Beta Dissolved pCi/l	Error 2σ*	Ra-226 Dissolved pCi/l	Error 2σ*
HER-044	1	±18	40	±11	0.8	±0.3

Sample	Th-230 Dissolved pCi/l	Error 2σ*	U Dissolved mg/l
HER-044	0.0	±0.3	0.0018

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16-Feb-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

Received: 8-Feb-90
Purchase order :

Job: 901940E

Status: Final

ADDITIONAL ANALYSIS

Abbreviations:

Analyses:

Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Abbreviations:

Units:

pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ
mg/l	: milligrams per liter

Signed: David Lasher

.....

David Lasher
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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16-Feb-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

Received: 8-Feb-90
Purchase order :

Job: 901940E

Status: Final

ADDITIONAL ANALYSIS

QUALITY CONTROL DATA SHEET

Time Received: Date: 2/8/90 By: G. Reichert Via: In House

Sample Container Type:
Sample Type: water
Preservative When Received: none
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Gr. Alpha	4	900.0	1.0 pCi/l	none	Kidwell	2/7-2/12
Gr. Beta	4	900.0	2.0 pCi/l	none	Kidwell	2/7-2/12
Ra-226	4,7,14	SM-705	0.2 pCi/l	none	Howard	2/9-2/13
Th-230	11	---	0.2 pCi/l	none	Ortiz	2/8-2/12
U	4,9,10,14	ASTMD2907	0.3 µg/l	none	Krizman	2/8-2/9

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER-044	U	0.0017	0.0018	2.9

ASTM D2907-97
Standard Test Methods for Microquantities of Uranium in Water by Fluorometry (Withdrawn 2003)
Scope

1.1 These test methods are applicable to the determination of microquantities of uranium in water in the concentration range from 0.005 to 50 mg/L.

BARRINGER LABORATORIES INC.

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16-Feb-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Attn:
Project:

Received: 8-Feb-90

Purchase order :

Job: 901940E

Status: Final

ADDITIONAL ANALYSIS

QUALITY CONTROL STANDARDS

These results are from the Lab Accuracy Test

Parameter	Result	Cert Result	Target Range	Relative Deviation % From Known
Gr. Alpha	197 ± 5	198	178 - 218	0.5
Gr. Beta	182 ± 2	173	156 - 190	5.2
Ra-226	114 ± 3	104	94 - 114	9.6
Th-230	93 ± 3	99	89 - 109	6.1
U	34	34	32 - 36	0

Approved by: David Larsen

cc: Bill Almas, ENERGY FUELS NUCLEAR

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

INVOICE

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Date : **22-Feb-90**

Job : **901940E**

Invoice: **8194E**

Authority: PO #:
Project: Terms: Net 30 Days

Sample Type: Water

Analyses:

1	Gross Alpha-Beta/Dissolved	18.00	$ 18.00
1	Ra-226/Dissolved	30.00	$ 30.00
1	Th-230/Dissolved	29.00	$ 29.00
1	U/Dissolved	15.00	$ 15.00

TOTAL DUE: $ 92.00

Remit to: Barringer Laboratories
15000 W. 6th Ave.
Suite 300
Golden, CO 80401

--- Original ---

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
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PHONE: (702) 358-1158

HER 044 is from 6/29/89

9-Jan-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 663E Status: Final

ADDITIONAL ANALYSES

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Specific Conductance µmho/cm	F mg/l
HER 044	91.8	<1	549	43	<0.01	3230	1.1

Sample	Mg Total mg/l	pH unit	PO4 as P Total mg/l	K Total mg/l	SiO2 mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l
HER 044	176	7.82	0.1	27.2	11.1	80.5	3350	2220

BARRINGER LABORATORIES INC.

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9-Jan-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 633E Status: Final

ADDITIONAL ANALYSES

Abbreviations:

Analyses:

HCO3	: Bicarbonate
CO3	: Carbonate
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
F	: Fluoride
Mg	: Magnesium
PO4 as P	: Phosphate
K	: Potassium
SiO2	: Silica
Na	: Sodium
TDS	: Total Dissolved Solids
SO4	: Sulfate

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter @ 25C

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
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9-Jan-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 633E Status: Final

ADDITIONAL ANALYSES

QUALITY CONTROL DATA SHEET

Time Received: Date: 12/15/89 By: T.Moncrief Via:

Sample Container Type:
Sample Type: water
Preservative When Received: 1.HNO3 2.none
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
PO4	1	365.1	0.1 mg/l	2	Hobbs	12/18
Cl	1	325.2	1 mg/l	2	Hobbs	12/18
Sp.Cond.	1	1201	0.001 mg/l	2	Hencmann	12/18
pH	1	150.1	0.01 unit	2	Acree	12/18
HCO3/CO3	1	210.1	1 mg/l	2	Acree	12/18
SO4	1	375.3	5 mg/l	2	Acree	12/18
Ca	1	200.7	0.01 mg/l	1	Hidalgo	12/18
Cr	1	200.7	0.01 mg/l	1	Hidalgo	12/18
K	1	200.7	0.5 mg/l	1	Hidalgo	12/18
Mg	1	200.7	0.01 mg/l	1	Hidalgo	12/18
Na	1	200.7	0.01 mg/l	1	Hidalgo	12/18
SiO2	1	200.7	0.01 mg/l	1	Hidalgo	12/18
F	1	340.2	0.05 mg/l	2	Acree	12/18
TDS	1	160.1	10 mg/l	2	Acree	12/19

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9-Jan-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 633E Status: Final

ADDITIONAL ANALYSES

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER 044	PO4	.13	.13	0.0
HER 044	Cl	42.8	42.8	0.0
HER 044	Sp.Cond.	3231.9	3231.9	0.0
HER 044	pH	7.82	7.82	0.0
HER 044	HCO3	91.8	91.8	0.0
HER 044	SO4	2217	2355	6.0
HER 044	Ca	549	540	1.6
HER 044	Cr	<.01	.01	---
HER 044	K	27.2	27.4	0.7
HER 044	Ng	176	172	2.3
HER 044	Na	80.5	79.0	1.9
HER 044	SiO2	11.1	10.9	1.8
HER 044	F	1.08	1.12	3.6

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PHONE: (702) 358-1158

9-Jan-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 633E

Status: Final

ADDITIONAL ANALYSES

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
PO4	.49	.50	.46 - .54	2.0	---
Cl	26.22	26.05	24.1 - 27.7	0.7	---
Sp.Cond.	1413	1413	---	0.0	---
SO4	1079	1000	900 - 1100	7.1	---
Ca	2.12	2.00	1.80 - 2.20	6.0	---
Cr	.213	.200	.180 - .220	6.5	104
K	10.2	10.0	9.0 - 11.0	2.0	101
Mg	2.00	2.00	1.80 - 2.20	0.0	93
Na	.85	.86	.76 - .96	1.0	---
SiO2	1.04	1.07	.96 - 1.18	3.0	113
F	.54	.50	.45 - .55	2.7	109
TDS	1470	1479	1331 - 1627	0.6	---

Approved by: _____

BARRINGER LABORATORIES INC.

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PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 344 Client PO No.

Sample Type: water

Date Collected: 5/31/89 Date Received: 6/2/89 Date Reported: 7/21/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HER041	159	159	<1	.006	<.01

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance umhos/cm	Cu Total mg/l
HER041	.005	546	39.6	.01	3200	.02

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	NO_3 as N mg/l
HER041	1.26	9.85	<.02	187	.17	.0002	<.1

Approved by D. Fauhn

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

Sample Identification	pH units	PO_4 as P mg/l	K Total mg/l	Se Total mg/l	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l
HER041	7.59	<.1	25.7	.018	12.1	<.01	82.0

Sample Identification	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l	S mg/l	Ra-226 (Total) pCi/liter ±Precision*
HER041	3470	88	2360	.015	<2	1.2 ± 0.4

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER041	140± 20	39 ± 11	0.0 ± 0.5	0.0029

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by D. Parker

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET

Time Received: 9:30 Date: 6/2/89 By: Gina Reichert Via: Fed. Express

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Nitrate	1	353.1	0.1 mg/1	2	D. Hobbs	6/6/89
Chloride	1	325.2	0.2 mg/1	3	D. Hobbs	6/7/89
Phosphate	1	365.1	0.01 mg/1	3	D. Hobbs	6/12/89
Mercury	1	245.1	0.2 ug/1	1	M. Swanson	6/15/89
Barium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Cadmium	1	200.7	5 ug/1	1	D. Hidalgo	6/19/89
Calcium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Chromium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Copper	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Iron	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Lead	1	200.7	2 ug/1	1	D. Hidalgo	6/19/89
Magnesium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Manganese	1	200.7	1 ug/1	1	D. Hidalgo	6/19/89
Potassium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Silica	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Selenium	1	270.2	1 ug/1	1	G. Gilleland	6/23/89
Conductance	1	120.1	0.1 umhos/cm	3	A. Knudson	6/26/89
Alkalinity	1	210.1	0.5 mg/1	3	M. Swanson	6/26/89
Arsenic	1	206.2	1 ug/1	1	G. Gilleland	6/27/89
pH	1	150.1	0.01 units	3	A. Knudson	6/28/89
Fluoride	1	340.2	0.1 mg/1	3	A. Knudson	6/29/89
Silver	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Sodium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Zinc	1	200.7	5 ug/1	1	D. Hidalgo	6/19/89
TSS	1	160.2	4 mg/1	3	A. Knudson	6/26/89
TDS	1	160.1	10 mg/1	3	A. Knudson	6/26/89
Sulfate	1	375.3	0.1 mg/1	3	A. Knudson	6/26/89

Approved by D. Parker

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
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PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Engery Fuels Nuclear, Inc.
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 9382 Client PO No.

Sample Type: water

Date Collected: 12/21-27/88 Date Received: 1/9/89 Date Reported: 1/30/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l
HR032	157	157	<1	.1

Sample Identification	As Total mg/l	Ba Total mg/l	B mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l
HR032 (WELL	.006	.04	.16	<.005	533	40.1

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

Sample Identification	Cr Total mg/l	Conductance umho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l
HR032	.01	3440	.04	1.41	7.33

Sample Identification	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l
HR032	<.02	177	.10	<.0002	.01

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

Sample Identification	NO_3 as N mg/l	PO_4 Total mg/l	pH units	K Total mg/l	Se Total mg/l
HR032	<1.0	<.1	7.40	21.6	.012

Sample Identification	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	TSS mg/l	SO_4 mg/l
HR032	12.6	<.01	73.6	3430	9	2220

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
South Hwy 89A
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 9382

Sample Identification	SO_3 ? mg/l	Zn Total mg/l	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*
HR032	<5	.136	12 ± 18	30 ± 10

Sample Identification	Ra-226 (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HR032	2.1 ± 0.5	0.6 ± 0.6	0.0024

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2 σ

Approved by Susan K Barbey

BARRINGER LABORATORIES INC.

18000 W. 8TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 356-1756

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 8851 Client PO No.

Sample Type: water

Date Collected: Date Received: 9/29/88 Date Reported: 11/15/88

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l	As Total mg/l
HR025 (Hermit Mine)	157	157	<1	<0.1	0.020

Sample Identification	Ba Total mg/l	B Total mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l
HR025 (Hermit Mine)	0.04	0.38	<0.005	494	42.3	0.13

Sample Identification	Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HR025 (Hermit Mine)	3340	0.02	1.32	6.21	<0.02	169

Approved by: M. Z.

Barringer Laboratories
15000 W. 6th Avenue
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Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 8851

Sample Identification	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO_3 as N mg/l	pH units	PO_4 as P mg/l
HR025 (Hermit Mine)	0.09	0.0003	0.05	<0.1	7.20	<0.1

Sample Identification	K Total mg/l	Se Total mg/l	SiO_2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l
HR025 (Hermit Mine)	19.4	0.037	11.0	0.02	69.5	3430

Sample Identification	TSS mg/l	SO_4 mg/l	Zn Total mg/l	Sulfite Total mg/l
HR025 (Hermit Mine)	14	2080	0.070	<2

Approved by M. Z-A

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Energy Fuels
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Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 8851

Sample Identification	Gross Alpha[1] (Total) pCi/liter ±Precision*	Gross Beta[1] (Total) pCi/liter ±Precision*	Ra-226 (Total) pCi/liter ±Precision*
HR025 (Hermit Mine)	76 ± 25	38 ± 11	0.4 ± 0.2

Sample Identification	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HR025 (Hermit Mine)	0.4 ± 0.4	0.0022

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

[1] Gross alpha & gross beta results are based on Thorium-230 and Strontium-90 calibration standards respectively.

Approved by [signature]

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PHONE: (702) 358-1158

Energy Fuels
One Tabor Center
Suite 2500
1200-17th Street
Denver, CO 80202

ATTN: Bill Almas

Client No. | Log No. 8386 Client PO No.

Sample Type: water

Date Collected: Date Received: 7/13/88 Date Reported: 8/17/88

INORGANIC FINAL
RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HR019	155	155	<1	0.015	0.02

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance µmho/cm	Cu Total mg/l
HR019	0.025	577	41	0.15	3210	0.02

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ATTN: Bill Almas

LGN: 8386

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HR019	1.39	7.48	0.15	192	0.11	0.0011

Sample Identification	NO_3 as N mg/l	PO_4 mg/l	K Total mg/l	Se Total mg/l	SiO_2 Total mg/l	Ag Total mg/l
HR019	<0.1	<0.01	24.4	0.006	12.8	0.02

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Sample Identification	Na Total mg/l	TDS mg/l	SO_4 mg/l	Zn Total mg/l
HR019	78.8	3450	2240	0.118

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1200-17th St.
Denver, CO 80202

ATTN: Bill Almas

Client No. | Log No. 8386 | Client PO No.

Sample Type: water

Date Collected: | Date Received: 7/13/88 | Date Reported: 8/10/88

RADIOCHEMISTRY FINAL
RESULTS OF ANALYSIS **

Sample Identification	Gross Alpha Total pCi/l ±Precision*	Gross Beta Total pCi/l ±Precision*	Ra-226 Total pCi/l ±Precision*
HR019	0 ± 16	27 ± 10	2.6 ± 0.6

How is Gross Alpha 0 but Ra-226 is 2.6? How is Gross Alpha lower than Gross Beta?

Sample Identification	Th-230 Total pCi/l ±Precision*	U Total mg/l
HR019	0.7 ± 0.7	0.0025

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ
** Inorganic results to follow at a later date

Approved by W. Barker

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ATTN: Bill Almas

LGN: 8386

QUALITY CONTROL DATA SHEET

Time Received: Date: 7/13/88 By: Gina Reichert Via: Federal Expres

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received 4. Zn Acetate

Additional Lab Preparation: none

Parameter	Reference	LLD	Preservative	Analyst	Date(s) of Analysis
Alpha-Beta	4	1.0,2.0 pCi/l	3	Ortiz & Kidwell	7/14-7/21/88
Radium 226	4,7	0.2 pCi/l	3	Howard, Goodale, Kidwell & Garcia	7/26-7/29/88
Thorium 230	11	0.2 pCi/l	3	Ortiz & Taylor	7/15-7/28/88
Uranium	9,10	0.2 pCi/l	3	B. Tonning	7/22-7/25/88

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Gross Alpha	193 ± 4	198	178 - 218	2.6%	---
Gross Beta	178 ± 2	175	157 - 193	1.7%	---
Radium 226	109 ± 3	101	96 - 106	8.0%	---
Thorium 230	100 ± 3	99	94 - 104	1.0%	---
Uranium	34	34	32 - 36	0.0%	101

These results are derived from the Lab Accuracy Test, which was performed over a year after these results are purported to be from

Approved by D. Parker

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Energy Fules Nuclear
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

ATTN: Rich Munson

Client No. Log No. 8106 Client PO No.

Sample Type: water

Date Collected: 4/28-4/29/88 Date Received: 5/2/88 Date Reported: 6/28/88

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	NH_4 as N mg/l	As Total mg/l
HR012	159	159	<1	<0.1	0.013

Sample Identification	Ba Total mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance µmho/cm
HR012	0.01	<0.005	585	43	0.10	3430

Sample Identification	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HR012	0.01	1.47	4.03	<0.02	183	0.06

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ATTN: Rich Munson

LGN: 8106

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	pH units	PO_4 mg/l	K Total mg/l	Se Total mg/l
HR012	0.0011	0.7	8.02	<0.1	25.3	0.009

Sample Identification	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l
HR012	13.6	0.01	70.1	3500	18	2230	<0.005

Sample Identification	Gross Alpha Total pCi/l ±Precision*	Gross Beta Total pCi/l ±Precision*	Pb-210 Total pCi/l ±Precision*
HR012	0 ± 19	31 ± 12	0.5 ± 0.9

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

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ATTN:Rich Munson

LGN: 8106

Sample Identification	Po-210 Total pCi/l ±Precision*	Ra-226 Total pCi/l ±Precision*	Ra-228 Total pCi/l ±Precision*
HR012	0.8 ± 0.5	3.5 ± 0.7	0.0 ± 0.7

Sample Identification	Th-230 Total pCi/l ±Precision*	U Total mg/l
HR012	0.0 ± 0.3	0.0025

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

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ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET

Time Received: Date: 5/2/88 By: Gina Reichert Via: Airplane

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. as received

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Fluoride	1	340.2	5 mg/l	3	A. Knudson	5/16/88
Conductance	1	120.0	0.1 mhos/cm	3	P. Huebner	5/16/88
Chloride	1	325.3	0.2 mg/l	3	D. Hobbs	5/16/88
Selenium	1	270.2	2 µg/l	1	T. Carr	5/13/88
Phosphate	1	365.1	0.01 mg/l	3	D. Hobbs	5/17/88
pH	1	150.1	0.01 units	3	P. Huebner	5/17/88
Alkalinity	1	310.1	0.5 mg/l	3	P. Huebner	5/17/88
Barium	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Cadmium	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Calcium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Chromium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Copper	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Iron	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Lead	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Magnesium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Manganese	1	200.7	3 µg/l	1	J. Hageman	5/18/88
Potassium	1	200.7	10 µg/l	1	J. Hageman	5/18/88
Ammonia	1	350.1	0.1 mg/l	3	D. Hobbs	5/3/88
Mercury	1	245.1	0.2 µg/l	1	G. Gilleland	5/12/88
Arsenic	1	206.2	1 µg/l	1	T. Carr	5/23/88
Silica	1	200.7	10 µg/l	1	J. Hageman	5/23/88
Silver	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Sodium	1	200.7	0.01 µg/l	1	J. Hageman	5/18/88
Zinc	1	200.7	5 µg/l	1	J. Hageman	5/18/88
Total Suspended Solids	1	160.2	4 mg/l	3	R. Lovell	5/17/88

Approved by

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ATTN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Total Dissolved Solids	1	160.1	10 mg/l	3	R. Lovell	5/19/88
Sulfate	1	375.3	0.1 mg/l	3	R. Lovell	5/19/88
Alpha-Beta	4		1.0,2.0 pCi/l	3	J. Ortiz	5/13-5/23/88
Lead 210	5		1.0 pCi/l	3	M. Kidwell	5/9-5/25/88
Polonium 210	6		1.0 pCi/l	3	J. Ortiz	5/11-5/12/88
Radium 226	4,7		0.2 pCi/l	3	M. Howard	5/9-5/18/88
Radium 228	12,13,14		0.9 pCi/l	3	K. Goodale	5/17-5/27/88
Thorium 230	11		0.2 pCi/l	3	Taylor & Ortiz	5/11-5/16/88
Uranium	9,10		0.2 pCi/l	3	B. Tonning	5/10-5/12/88

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HR012	Fluoride	1.49	1.49	3.4%
HR012	Conductance	3370	3480	3.2%
PN011	Chloride	16	16	0.0%
HR012	Selenium	0.009	0.008	11.0%
PN011	Phosphate	<0.1	<0.1	0.0%
HR012	pH	7.99	8.04	0.6%
HR012	Alkalinity	159	159	0.0%
PN011	Ammonia	<0.1	<0.1	0.0%
HR012	Silver	<0.01	<0.01	0.0%
HR012	Sodium	0.23	0.24	4.3%
HR012	Zinc	0.011	0.011	0.0%
HR012	Total Dissolved Solids	3510	3500	0.4%
HR012	Total Suspended Solids	17	19	11.0%
HR012	Sulfate	2230	2230	0.0%

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ATIN: Rich Munson

LGN: 8106

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Fluoride	0.51	0.50	0.45 - 0.55	2.0%	102
Chloride	26.5	25.85	22.3 - 28.7	2.4%	98
Selenium	0.009	0.009	0.006 - 0.012	0.0%	104
Phosphate	0.47	0.50	0.46 - 0.54	6.2%	---
Barium	0.98	0.97	0.82 - 1.12	1.0%	97
Cadmium	0.098	0.094	0.080 - 0.108	4.0%	103
Calcium	250	250	214 - 288	0.0%	101
Chromium	0.100	0.103	0.088 - 0.118	3.0%	103
Copper	0.105	0.103	0.088 - 0.118	2.0%	102
Iron	0.096	0.102	0.087 - 0.117	6.0%	110
Lead	0.106	0.101	0.086 - 0.116	5.0%	105
Magensium	0.103	0.100	0.085 - 0.115	3.0%	97
Manganese	0.104	10.02	0.087 - 0.117	2.0%	105
Potassium	9.84	10.0	8.5 - 11.5	1.6%	103
Ammonia	2.00	1.98	1.78 - 2.18	1.0%	97
Merucry	0.005	0.005	0.003 - 0.006	0.0%	75
Arsenic	0.099	0.100	0.080 - 0.118	1.0%	80
Silica	1.20	1.07	0.91 - 1.23	13.0%	119
Silver	0.97	0.99	0.84 - 1.14	2.0%	98
Sodium	0.80	0.86	0.73 - 0.99	6.0%	92
Zinc	0.106	0.101	0.086 - 0.116	5.0%	114
Total Dissolved Solids	1479	1479	1331 - 1627	0.0%	---
Sulfate	1030	1000	900 - 1100	3.0%	---
Gross Alpha	198 ± 6	198	178 - 218	0.0%	---
Gross Beta	108 ± 2	104	94 - 114	3.7%	---
Lead 210	112 ± 1	112	106 - 118	0.0%	---
Polonium 210	109	112	106 - 118	2.7%	---
Radium 226	104 ± 3	101	96 - 106	3.0%	---
Radium 228	40 ± 2	40	38 - 42	0.0%	---
Thorium 230	97 ± 3	99	94 - 104	2.1%	---
Uranium	32	34	32 - 36	5.9%	---

Acceptable alpha should be >20 pCi/L

EPA MCL = 30 ppb

Approved by _____

File Divider Page

100299

Project 90-275-01
June 1991

Canonie Environmental

Report

Water Quality Data Evaluation

Hermit Mine Site
Fredonia, Arizona

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

Prepared for:

Energy Fuels Nuclear, Inc.
Denver, Colorado

003

Report

Water Quality Data Evaluation

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Canonie Environmental

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WATER QUALITY DATA EVALUATION
HERMIT MINE SITE

1.0 INTRODUCTION

Canonie Environmental Services Corp. conducted a water quality data evaluation for Energy Fuels Nuclear, Inc.'s (EFN) Hermit Mine site in Fredonia, Arizona. The purpose of the evaluation was to determine potential causes of unanticipated exceedances of ground water quality standards for water samples collected from the monitor/production well (Well Registry No. 55-518877) at the Hermit Mine site.

Were the samples actually collected from R/M well 518877?

1.1 Background

The evaluation is part of EFN's program of proposed actions to determine the causes of the unanticipated exceedances of water quality standards established for the site. The program was presented in the document entitled "Hermit Mine, Groundwater Monitoring Report, Mining Phase" dated February 12, 1990 (EFN, 1990) that was submitted to the Arizona Department of Environmental Quality in accordance with the Hermit Mine Groundwater Quality Protection Permit (Permit) requirements for reporting. As discussed in the report, exceedances of the Maximum Groundwater Limits (MGLs) were identified for water quality samples collected from the monitoring well during the Mining period (September 1989 through December 1989). Exceedances of the MGLs continued to occur into the Post-Mining period prior to the initiation of this program (February 1990 through August 1990).

Table 1.1 presents a summary of the MGLs and the water quality data reported for the Mining and Post-mining periods. The samples were analyzed for total concentrations, except for the constituents that are shown boxed on Table 1.1, which were analyzed for dissolved concentrations. Exceedances of the MGLs are indicated as shaded values. As shown, concentrations of uranium have consistently exceeded the MGLs in the water samples except for sample HER 066 collected and analyzed in June 1990. Additionally, 15 other parameters or constituents, including specific conductance, alkalinity, bicarbonate, chloride, phosphate, calcium, magnesium, potassium, sodium, barium, iron, manganese, gross beta, radium-226, and thorium-230,

were reported in concentrations exceeding the MGLs in one or more samples during this same time period.

Several potential causes of the exceedances were discussed in EFN's report (EFN, 1990) including:

1. Increased sediment in the water;

2. Errors due to sampling and/or analytical procedures and variability; and

3. Natural conditions or seasonal changes in water quality due to factors such as variable precipitation.

Mining activities, e.g., seepage from the mine, were not discussed as a potential cause of the exceedances because of the physical separation of the mine workings from the aquifer by more than 1,000 feet of impermeable material. A discussion of the effectiveness of the physical barrier was included in the EFN's February 1990 report (EFN, 1990).

EFN implemented this program to evaluate whether the increased sediment and/or the sampling/analytical procedures could be the cause of the exceedances. The evaluation consisted of the following four tasks:

1. Task 1 - Review of existing water quality data to identify trends or patterns, particularly an increasing trend in constituent concentrations indicating that mining caused a deterioration in water quality.

2. Task 2 - Review of sample collection and handling procedures to determine whether the procedures followed generally accepted practices and, if not, evaluate whether the exceedances could be the result of a failure to implement adequate collection or handling procedures.

3. Task 3 - Implementation of a laboratory Quality Assurance/Quality Control (QA/QC) program to identify potential laboratory analytical error and evaluate whether the exceedances could be related to any errors identified.

4. Task 4 - Review of water quality standards to evaluate the appropriateness of the standards contained in the Permit, particularly for the radionuclide constituents.

1.2 Summary of Results

The results of the water quality data evaluation indicated that the water quality at the Hermit Mine site has not deteriorated as a result of mining activities and that the exceedances of the MGLs for constituents measured in the water samples from the monitor/production well were the result of a combination of increased sediment load and improper sample collection procedures. This conclusion is based on the following factors:

1. The quality of the water in the mine, represented by the samples from the sump, is similar to the quality of the aquifer, represented by the samples from the well. The only exceptions are the radionuclides, nitrate, and arsenic which are present in the sump water in concentrations 10 to 10,000 times higher than the concentrations measured in the well water, and iron and manganese which are present in the sump water in concentrations 2 to 40 times lower than in the well water.

2. If seepage from the mine were the source of the exceedances in the well water, then the constituents that are present in the highest concentrations in the sump water as compared to the concentrations in the well water (radionuclides, nitrate, and arsenic) would be expected to exhibit increasing concentrations (and exceedances of the standards) in the well water after mining operations commenced. However, radionuclide concentrations, which exhibit the highest contrast in concentrations between the sump water and the well water, do not show a trend of increasing concentrations after

good pt. argument doesn't necessarily hold for other constituents but NO_3^- should be a good tracer.

Why would nitrate be a good tracer for this type of mine? Nitrate should be insignificant, this is not a mill

mining activities commenced. Rather, the exceedances that are reported are erratic as the reported concentrations fluctuate at levels below and above the MGLs. Also, the concentrations of nitrate and arsenic remained stable at levels below the MGLs throughout the Mining and Post-mining periods.

3. As a contrasting argument, if seepage from the mine was the cause of the exceedances of the MGLs in the well water, then constituents such as iron and manganese, which are present in the sump water in concentrations several times lower than the concentrations in the well water, would not be expected to show a trend of increasing concentrations or exceedances of the MGLs after mining operations commenced. However, both iron and manganese are reported in concentrations exceeding the MGLs for 60 to 100 percent of the well water samples collected during the Mining and Post-mining periods.

4. A trend of increasing constituent concentrations was evident during the Pre-mining period, prior to commencement of mining operations. This trend continued into the first months of the Mining period, after which concentrations stabilized.

5. The increase in constituent concentrations and exceedances of MGLs reported during the Mining period coincide with an increase in the sediment in the water that began during the Pre-mining period.

6. The sediment load in the water, as indicated by the concentrations of total suspended solids (TSS), increased from very low levels [9 to 14 milligrams per liter (mg/l)] during the Pre-Mining period to higher levels (40 to 90 mg/l) during the Mining and Post-mining periods.

7. The volume of water purged prior to sample collection was three casing volumes for this evaluation as compared to only one casing volume for previous sample collection events.

Well 518877 is not fully cased. And is an operating water well - why would three purges be necessary if this well was used?

8. The number of constituents reported in concentrations exceeding the standards was 1 for the three replicate samples collected for this evaluation, as compared to 2 to 7 constituents for previous sampling events. Also uranium did not exceed the MGLs in the three replicate samples analyzed for this evaluation in contrast to past analyses where uranium concentrations exceeded the MGLs in 9 out of 10 samples.

9. The analytical precision and accuracy quantified from the laboratory QA/QC program was acceptable for almost all the constituents analyzed.

Also, the evaluation indicates that water quality standards are inappropriately applied to certain constituents, in particular gross alpha and gross beta. According to the National Interim Primary Drinking Water regulations Part 141.15(a) and Part 141.15(b), gross alpha and gross beta activities are included in water quality analyses to screen for the presence of alpha- and beta-emitting radionuclides. Once the screening identifies the presence of the radionuclides, then the gross alpha and gross beta analyses can be eliminated and only the alpha- and beta-emitting radionuclides are monitored.

Rather than determining the gross alpha and gross beta activities from the screening analytical procedure, they can be calculated from the measured concentrations of the radionuclides. Since the screening technique is not accurate, analysis of the radionuclide concentrations provides a more accurate estimate of the gross alpha and gross beta activities.

Furthermore, a standard is normally applied to gross beta only if man-made radionuclides such as strontium or tritium are present. Since no man-made radionuclides are present at the Hermit Mine site, the application of a gross beta standard is not appropriate.

1.3 Recommendations

Based on the results of the evaluation, several recommendations were developed to improve the quality and reliability of the water quality monitoring program for the Hermit Mine site. These recommendations include the following:

1. Purge a minimum of three casing volumes prior to sampling the well.

2. Monitor the indicator parameters, pH, specific conductivity, and temperature during the purging process. A difference of 10 percent or less between measurements taken at the beginning and end of the third casing volume purge will indicate that an adequate volume has been purged.

3. Order reanalysis of any constituents that are reported in concentrations exceeding the standards to minimize the exceedances that may be related to laboratory error.

4. Eliminate gross alpha and gross beta from the list of constituents monitored under the Permit.

2.0 WATER QUALITY DATA EVALUATION

The water quality data evaluation consisted of the following four tasks:

1. Task 1 - Review of existing water quality data;
2. Task 2 - Review of sample collection handling procedures;
3. Task 3 - Implementation of a laboratory QA/QC program; and
4. Task 4 - Review of water quality standards.

A description of these tasks is provided in the following sections.

2.1 Task 1 - Review of Existing Water Quality Data

A review of existing water quality data was conducted to determine whether any trends or other indications of water quality deterioration were evident. The review focused on determining whether trends could be identified that indicated that the exceedances of the standards were consistent and could be related to a cause such as an introduction of contaminated water from the mining activities.

For example, an increasing trend in the concentration of metals and radionuclides would be expected if mine water migrated into the aquifer. As stated in the Permit, the purpose of the Mining and Post-mining water quality monitoring is to determine:

1. What impacts, if any, the mining operation is having on the ground water quality (of the Redwall-Muav aquifer); and
2. The effectiveness of the closure activities (to prevent impacts on ground water quality after the mine is closed).

If the mining were to have an impact on water quality, the impact would be an increase in constituent concentrations, measured in the monitoring well.

Increases in constituent concentrations would be expected for certain metals and radionuclides which are present in higher concentrations in the mine water than in the aquifer. Therefore, a trend of increasing concentrations of metals and radionuclides after mining operations started would indicate that mine water was contaminating the aquifer. Similarly, if mine closure activities were not effective in preventing the migration of mine water to the aquifer, then constituent concentrations would be expected to increase or continue to increase after mining operations ceased.

The review showed that the quality of the water in the mine is similar to the quality of the water from the well. The only exceptions are nitrate, arsenic, and the radionuclides which are present in the mine water in concentrations exceeding the ambient quality of the aquifer (as represented by the MGLs) by one to four orders of magnitude. If mine water had impacted the quality of the aquifer, concentrations of these constituents would be expected to reflect an increasing trend in concentrations . However, these constituents did not exhibit increasing concentrations in the Mining and Post-mining periods. Rather, the concentrations either fluctuated at levels exceeding the MGLs (e.g. the radionuclides) or remained at concentrations below the MGLs (e.g. nitrate and arsenic).

The review also indicated that the exceedances are in part related to the increased sediment load in the water. The trend of increasing constituent concentrations evident during the Pre-mining period coincides with an increase in the amount of sediment in the water as indicated by increasing TSS concentrations and observations by EFN personnel.

Testing should be for dissolved solids anyway

probably just accentuated by pumping the well

The following sections provide a discussion of the database used and a description of the review process.

2.1.1 Database

The database used for the review consisted of the analyses of samples collected from the well prior to mining (Pre-Mining), during mining (Mining), and after mining ceased (Post-Mining) and from the mine sump

during Mining. Five quarterly samples were collected from the monitor well during the Pre-Mining period (April 1988 to May 1989). The Mining period samples, including four samples from the mine sump and four from the well, were collected between June 1989 and December 1989. Finally, a total of six well samples and one sump sample have been collected during the Post-Mining period since January 1990.

In accordance with the Permit, the analyses of the Pre-Mining samples from the well were used to characterize the ambient water quality and to establish MGLs for water samples from the mine site monitor well. The Pre-Mining samples were all analyzed for total rather than dissolved concentrations of constituents. As a result, the MGLs established for the site are for total concentrations. Therefore, for the evaluation of trends, only the Mining and Post-mining samples that were analyzed for total constituent concentrations were included.

Analytical results for dissolved concentrations were not included in this evaluation because the sample preparation for dissolved constituents is different from the procedure for total constituents and the analytical results are not comparable. Samples for analysis of dissolved constituents (metals) are filtered prior to preservation with acid. The filtration process removes sediment or suspended solids.

In contrast, samples prepared for analysis of total metals are not filtered prior to acidification. As a result, total metals concentrations may be higher than dissolved concentrations because metals adsorbed to or contained in the sediment/suspended solids can be added to the sample water by the acidification process. Therefore, inclusion of the dissolved metals analytical results would confuse the interpretation of the data, especially evaluation of changes in concentration over time (trends), since these results can represent different water quality conditions than those represented by the total concentration results.

Table 2.1 lists the data that were used in the evaluation. Note that dissolved concentrations of metals were analyzed for samples HER-061

through HER-069. Therefore, no metals concentrations are reported for these samples.

Why not? Isn't the dissolved constituents are what is of concern?

2.1.2 Data Review

The first step in the evaluation consisted of a comparison of the quality of the water from the aquifer (i.e. the well) and from the mine (i.e. the mine sump). The mine sump samples represent the quality of the water that would impact the aquifer quality if communication between the mine and the aquifer existed. Table 2.1 presents the analytical results for the water samples collected from the sump and the well during the mining period. Sampling of the sump was not required under the Permit after mining operations ceased.

Review of Table 2.1 shows that the quality of the water in the sump is similar to the water in the well with the exception of nitrate, several metals and the radionuclides. For example, sulfate concentrations measured in the well ranged from 1150 mg/l to 2310 mg/l with 90 percent of the values falling in the range of 2240 mg/l to 2300 mg/l. Sulfate concentrations in the sump water ranged from 2180 mg/l to 2300 mg/l with an average concentration of 2243 mg/l. The metals concentrations in the sump and well water were either the same or, in one or two of the samples, differed by no more than 50 percent.

In contrast, the concentrations of nitrate, arsenic, and radionuclides in the samples from the mine sump were 10 to 10,000 times higher than the concentrations in the well water. As shown in the table, concentrations of the radionuclides exhibited the greatest magnitude of difference in concentration (3 to 4 orders of magnitude) between the sump water and the well water. Nitrate concentrations in the sump water were in the range of 6.0 mg/l to 51.3 mg/l whereas the concentrations in the well water were below the detection limit of 0.1 mg/l. These concentrations are also 8 to 64 times higher than the background levels of the well water represented by the MGL of 0.8 mg/l. Finally, the arsenic concentrations in the sump water ranged from 0.205 mg/l to 1.09 mg/l which is 8 to 40 times higher than the background concentration of 0.204 mg/l.

Where is the nitrate coming from? Is the sump near the septic tank or livestock pond?

How is the background As 204 ppb? Maybe 24 ppm? Hunt/Hermit well (503919) in 1983 As = 28 ppb, Kanab R/M Well in 1985 As= 10 ppb

If communication between the mine and the aquifer did exist, then evidence for the communication would be an increase in the concentrations of those constituents in the highest concentrations in the sump water as compared to the same constituents in the well water. As discussed above, these constituents are the radionuclides, nitrate, and arsenic.

However, as shown in Table 2.1, nitrate concentrations in water samples from the well remained below both the MGL and the detection limit and arsenic concentrations remained 3 to 6 times below the MGL throughout the Mining and Post-mining periods. Of the radionuclides, only uranium was reported in concentrations that consistently exceeded the MGL throughout the Mining and Post-mining periods. The remaining radionuclides either did not exceed the MGLs (gross alpha) or exhibited erratic exceedances (gross beta, radium-226, and thorium-230). The fact that the well water does not exhibit an increase in the concentrations of the constituents of highest contrast in concentration indicates that a source other than mining activities is the cause of the exceedances in the well water.

A contrasting argument also provides support for the conclusion that a source other than communication between the mine and the aquifer is the cause of the exceedances in the well water. Review of Table 2.1 shows that two additional constituents, iron and manganese, are also present in substantially different concentrations in the sump water as compared to the well water. However, in contrast to the previous discussion, the concentrations of these two constituents in the sump water are less than in the well water. Iron concentrations in the sump samples ranged from 0.11 mg/l to 0.29 mg/l, which is 10 to 100 times lower than the concentrations in the well water. Similarly, manganese concentrations ranged from 0.04 mg/l to 0.08 mg/l, which is 2 to 5 times lower than the concentrations in the well water.

Fe & Mn (and As) are from oxidation & dissolution of pyrite

How did the Fe and Mn become elevated in the Hermit R/M well? The Fe in Kanab R/M water well <0.1 mg/L , at Hack well (1982) Fe< 0.05 mg/L

Since the concentrations of these two constituents are much lower in the sump water than in the well water, an increase in their concentrations in the well water could not be caused by seepage of water from the mine. Therefore, an increase in concentration of these two constituents in the well water during the Mining and Post-mining periods would indicate that a

Wrong, Water seeping down could have oxidised the sulfide mineralization in the pipe and carried it down to R/M

No, mine seepage is causing the increase

mechanism other than mine seepage was causing the increase. Review of Table 2.1 shows that the concentrations of iron and manganese exceeded the MGLs in 60 percent and 100 percent, respectively, of the well water samples collected during the Mining and Post-mining periods. These exceedances indicate that the quality of the aquifer changed as a result of causes unrelated to the mining activities.

One of the potential causes of the exceedances in the well water is the increased sediment in the well. A discussion of the increased sediment was first addressed in EFN's mining phase report (EFN, 1990) that identified the exceedances of the MGLs and presented the proposed program for evaluating the exceedances. According to EFN personnel, the increased sediment became noticeable in January and February 1989 because of a color change from clear to red and deposition of sediment in the components of the pump that are located at the ground surface.

Review of Table 2.2 confirms the observations made by EFN personnel that the sediment load increased during the Pre-mining period. Concentrations of TSS for the three samples collected prior to January/February 1989 ranged from 9 mg/l to 18 mg/l. The concentrations of TSS increased 5 to 10 times (to 88 mg/l) in the sample collected in May 1989. Concentrations of TSS remained high into and through the Post-mining period. Analyses of TSS were not conducted during the Mining period. However, concentrations reported for the Post-mining period ranged from 42 mg/l to 93 mg/l with an average of 61 mg/l.

Assuming that the the sediment was the cause of the exceedances of the MGLs, increases in constituent concentrations would be expected to coincide with increased concentrations of TSS. To determine whether such a relation exists, concentrations of TSS, uranium, iron, and manganese were plotted on a graph. Figure 2-1 illustrates the resulting graphs.

The figure clearly illustrates that the increased concentrations of TSS coincide with increases in the concentrations and with the exceedances of the MGLs noted for the three metals. Note that all three metals show a trend of increasing concentrations during the Pre-mining period, when TSS

concentrations also increased. TSS concentrations remained elevated into the Post-mining period and the concentrations of the three metals also remained higher during this time as compared to the Pre-mining period.

The figure also shows that the concentrations of dissolved uranium were an order of magnitude less than the concentrations of total uranium. If no sediment or suspended solids are present in the water, these two concentrations are very similar. However, as discussed in the beginning of this section, total concentrations can be higher than dissolved concentrations if sediment in the water contributes additional metals (uranium is considered to behave as a metal chemically) during the acidizing process. Therefore, the contrast between the total and dissolved uranium concentrations provide further evidence of the presence of the sediment in the water.

In summary, the review of the existing data clearly indicates that sediment in the well water is one of the causes of the exceedances of the MGLs and that the exceedances are not related to mining activities. Other potential causes of the exceedances will be evaluated in the following sections.

2.2 Review of Field Sampling Procedures

A review of the field sample collection procedures was conducted to determine whether the procedures follow generally accepted practices. Sampling procedures were also evaluated to determine whether they could be a cause of the exceedances.

The field sample collection procedures used by EFN follow the provisions of the Permit. Overall, the sample collection and handling procedures used should minimize any error. However, in accordance with the Permit monitoring requirements, only one casing volume is being purged prior to sample collection. One casing volume may not be sufficient to remove all the stagnant water in the well and, as a result, the collected water samples may not have been of consistent quality or representative of the formation water. Removal of the stagnant water is especially a concern in light of

the results of the previous task which indicated that sediment in the water may have caused the exceedances.

Thorough flushing (purging) is necessary to obtain representative ground water samples. A thorough purge is an effort to fill the well with fresh formation water. According to Wilson and Rouse (1983), the quality of standing or stagnant well water may differ from formation water; therefore, purging is necessary to ensure that the sample is fresh water representative of aquifer conditions.

The number of casing volumes that need to be purged varies depending on the well construction and the transmissivity of the aquifer (the rate at which water can be transmitted through a unit thickness of the aquifer), but the minimum number recommended is three casing volumes. The Environmental Protection Agency (EPA), in the document entitled "RCRA Ground-Water Monitoring Technical Enforcement Document" (EPA, 1986), recommends that three casing volumes be purged. Removal of at least four well casing volumes is recommended by a number of authors studying monitor well purge phenomena (Gibb, 1984; Shuller, et al., 1981; Keith, et al., 1983; Giddings, 1983; Urwin and Huis, 1983; Wilson and Rouse, 1983; Schmidt, 1982; Seanor, 1984; Seanor and Brannaka, 1983; Scalf, et al., 1981; United States Geological Survey, 1980).

The above-listed authors also generally recommend monitoring of the indicator parameters (temperature, pH, and specific conductivity) during the purging process to determine when the water quality has stabilized. The EPA (1986) also requires that these parameters be monitored as part of the purging process. Stabilization of the parameters provides an indication that the stagnant water has been removed and that clean formation water is being pumped. However, past sampling procedures have not included monitoring for the indicator parameters. As a result, verification that the water quality is stable and representative of the formation water has not been possible.

Table 2.3 presents a comparison between new data obtained from three ground water replicate samples collected for this evaluation and previous ground

water quality data. The samples for this program were collected after purging approximately three casing volumes rather than one volume as in previous sample collection events. The comparison was made by comparing the number of constituents that exceeded the MGLs for each sample.

The results of the comparison indicate that the erratic exceedances of the MGLs in the Mining and Post-mining water quality data were due to insufficient purge volume. As shown in Table 2.3, only one constituent, gross beta, was reported in concentrations exceeding the MGLs for the three replicate samples collected during this evaluation. In contrast, the table shows that in the past a total of 15 different constituents have been reported in concentrations exceeding the MGLs. The most notable improvement was exhibited by uranium which did not exceed the MGLs in the samples collected for this evaluation whereas previously concentrations of uranium exceeded the standards in 9 out of 10 samples.

Review of Table 2.1 shows that samples collected in the past had 2 to 7 constituents reported in concentrations exceeding the MGLs as compared to only one constituent in this set of samples. The fact that only one exceedance is evident for samples collected during this evaluation, and 2 to 7 times that number of exceedances were evident during previous sample collection events, indicates that the insufficient purging procedures effected the analytical results. Also, the exceedances that were evident in the previous samples were present as erratic fluctuations from low concentrations to high, indicating that the water quality was changing over the short time periods of one to three months between sampling events. Erratic fluctuations in water quality do not normally occur if a contaminant source, such as the mine, is the cause of the change in water quality. Consequently, one casing volume appears not to be sufficient to remove all the stagnant water in the well.

Support for this conclusion is provided by preliminary data from samples collected after sample collection for this evaluation in October 1990. The graph of uranium concentrations presented on Figure 2-1 includes data for samples collected in November and December, 1990, and January, 1991. The samples were collected after a minimum of three casing volumes was purged

from the well. As shown, the concentrations of uranium for all three samples were below the MGL and were even lower than the concentrations reported during the Pre-mining period.

Also, the concentration of TSS in the three replicate samples was 4 mg/l, as compared to an average of 61 mg/l for the five Post-mining water quality samples collected prior to this evaluation. The additional purge volumes helped to remove the sediment that was in the stagnant water in the well.

Future sample collection events using the higher purge volume of at least three casing volumes and monitoring of the indicator parameters during purging will verify this conclusion.

2.3 Task 3 - Laboratory QA/QC Evaluation

The evaluation of laboratory analytical performance was conducted to satisfy the following:

1. To assess the analytical accuracy of the analytical laboratory;

2. To determine the analytical laboratory's internal level of precision;

3. To assess the variability of sample results that may result from sample transport and/or sample handling in the laboratory; and

4. To compare the analytical laboratory's accuracy performance with an independent laboratory.

Samples were submitted to Barringer Laboratories, Inc. (Barringer), the laboratory that typically conducts the analyses of the Hermit Mine water quality samples. The independent laboratory used in the evaluation was AccuLabs Research, Inc. (AccuLabs).

2.3.1 Program Design

The laboratory QA/QC evaluation was designed to evaluate the performance of the laboratory in analyzing the constituents that are required in the Permit. Table 2.4 lists the analytes that were included in the evaluation. This evaluation was based on the analysis of the following five types of QA/QC samples:

1. Spike samples;
2. Spike sample replicates;
3. Ground water sample replicates;
4. Trip blank samples; and
5. Field blank samples.

All the QA/QC samples were shipped to Barringer and AccuLabs from the field and were "blind," or indistinguishable from ordinary ground water samples in labeling and packaging, so the laboratories could not identify them as QA/QC samples.

An explanation of the purpose of each of the sample types is provided below:

Spike Samples - A spike sample is a laboratory-prepared solution of deionized water containing known concentrations of analytes. Analyses of spike samples are used to assess the accuracy of the laboratory, i.e., the ability of a laboratory to determine the correct concentration of each analyte.

A spike sample was prepared from a single parent solution by Energy Laboratories in Casper, Wyoming. As shown in Table 2.4, the sample contained known concentrations of ions (sodium, potassium, chloride, and sulfate), total dissolved solids (TDS), metals (chromium, iron, manganese, and zinc),

and uranium. The spike sample also contained a known level of gross alpha due to uranium activity.

For the purpose of this program, an additional spike sample was split from the parent spike sample and sent to AccuLabs to compare the accuracy results of Barringer to an independent laboratory.

Spike Replicate Samples and Ground Water Replicate Samples - Replicate samples are used to assess laboratory precision. Replicate samples consist of a group of samples that contain the same water chemistry. Ideally, the laboratory should produce the same results for each replicate. Analysis of the spike replicate samples provides information on the laboratory's precision and may also be used to relate the laboratory's precision to accuracy.

For the purpose of this program, three replicate samples were prepared from the spike solution and three from the ground water sample. Each spike and ground water replicate sample was then sent to Barringer from the field.

Table 2.4 lists the analytes for the spike replicate and ground water replicate samples. Precision analyses were performed for all analytes showing detectable concentrations in the replicate samples.

Field Blank Samples - A field blank consists of deionized water that is placed into a sample container in the field. Ideally, if samples are collected correctly and sample containers are not contaminated, the analyses of field blanks should yield nondetectable concentrations for all metals and radionuclides. The use of field blanks provides a measure of variability that may be occurring as a result of sample handling in the field. For this program, one field blank labeled in a "blind" manner was sent to Barringer. Table 2.4 lists the analytes for the field blank sample.

Trip Blank Samples - A trip blank contains deionized water sealed in a sample container at the preparing laboratory. Trip blanks were prepared and then shipped "blind" to Barringer. Ideally, analyses of trip blanks should give nondetectable concentrations for all metals and radionuclides.

These blanks determine whether any contamination or other accuracy problems occur as a result of the sample handling and/or analytical procedures of the analytical laboratory. Table 2.4 lists the analytes for trip blanks.

2.3.2 Evaluation of Results

The results of this evaluation are presented in terms of the laboratory accuracy in analyzing the spike samples, precision in analyzing the replicate samples, and the number of constituents reported in detectable concentrations for the blank samples. Based on EPA guidelines (EPA, 1989), the laboratory performance in terms of accuracy and precision was acceptable for all constituents with the exception of zinc and gross alpha. The number of detectable constituents in the blank samples was low.

The fact that the laboratory had acceptable performance for most of the constituents, several of which were reported in concentrations in the well water exceeding the MGLs, indicates that error due to laboratory analytical procedures is not a cause of the exceedances in the well water. Although the laboratory performance for analyzing zinc and gross alpha was unacceptable, neither of these constituents was reported in concentrations exceeding the MGLs in samples collected from the well during the Mining or Postmining periods.

Laboratory Accuracy

Laboratory accuracy was determined based on the analytical results of the spike samples. Table 2.5 lists concentrations of the 11 selected chemical constituents in the spike sample. These are the values that are known to exist in the spike sample prior to laboratory analysis. Table 2.5 also provides the chemical concentrations or values that were reported by Barringer for each replicate of the spike sample. Since each spike replicate sample was drawn from a single parent solution, the analytical results for all the replicates should be identical to the known spike sample concentrations.

Accuracy is represented by the magnitude of the difference between the concentration in the spike sample and the concentration reported by the laboratory. The smaller the difference between the two values, the greater the accuracy. For example, review of Table 2.5 shows that for chromium, the spike sample value and the three spike replicate values were the same. Therefore, the accuracy of Barringer for analyzing chromium was high. In contrast, the large difference between the spike sample values and the three reported values existing for gross alpha indicates that Barringer has low accuracy in analyzing this radionuclide.

In order to quantify the accuracy of Barringer for each analyte, the values reported were normalized. Normalized values are reported as a percentage and represent the relative percent difference (RPD) between the reported laboratory value and the spike value.

The normalizing procedure utilized the following formula:

$$RPD = \left| \frac{VR}{VS} - 1 \right| \times 100$$

Where: VR is the laboratory-reported value of constituent X; and
VS is the known or spike value of constituent X.

The purpose of normalizing the values is to prevent the assessment of accuracy from being skewed by differences in the actual spike values for different constituents. The rationale for this procedure is evident if one considers an example where the spike value is 1.0 mg/l and the reported value is 0.9 mg/l. Using the above formula, this yields an RPD of 10 percent. Using the same procedure, a sample RPD of 10 percent would also be calculated for the situation where the spike value is 100 mg/l and the reported value is 90 mg/l.

For water quality samples, the EPA in their "Statement of Work" for the Contract Laboratory Program (EPA, 1989) recognizes that an RPD of less than 20 percent is the acceptable accuracy for laboratory analyses. Ideally, the RPD should be zero but, because of variability inherent in the analytical process, this ideal accuracy is not practically achievable.

Results of Evaluation

RPD values computed from the analyses of the spike samples are displayed in Table 2.5 and illustrated on Figures 2-2 through 2-4. The RPD values were then further classified as being representative of acceptable or unacceptable accuracy based on the 20 percent RPD criteria.

Figure 2-2 shows RPD values for each major ion constituent. Barringer demonstrated adequate accuracy for sodium, potassium, chloride, sulfate, and TDS in all cases.

Figure 2-3 shows RPD values for each metal spike constituent. Barringer demonstrated consistently adequate accuracy for chromium, iron, and manganese in all cases. However, Barringer did not meet the EPA accuracy criteria for zinc in three out of three samples or 100 percent of the time.

The cause for the poor accuracy performance for zinc is believed to be contamination in the laboratory during analysis. Zinc is ubiquitous in the environment and could have been incorporated in the samples when the sample containers were opened for the analyses. Also, zinc is not a concern from a water quality standpoint because it has never been reported in concentrations exceeding the MGLs.

Figure 2-4 shows RPD values for uranium and gross alpha. Barringer demonstrated consistently adequate accuracy for uranium. However, Barringer did not meet the EPA accuracy criteria for gross alpha in the spike samples in three out of three times or 100 percent of the time. As with zinc, the poor accuracy for gross alpha is not a concern from a water quality standpoint since it has never been reported at activity levels exceeding the MGLs. — The reason may be that Barringer's values are consistently low.!!

And the Gross Alpha MGL was set ridiculously high

Verification of Spike Sample and Analytical Accuracy

In order to verify that the spike sample contained the concentrations as indicated by the laboratory preparing the spike (Energy Laboratories) and to provide an independent check of analytical accuracy, one spike replicate

sample was shipped blind to AccuLabs for analysis. Table 2.6 presents the analytical results from both laboratories for the same spike sample. The results from Barringer presented in the table are mean values for the three spike replicate samples.

As shown in Table 2.6 both analytical laboratories demonstrated acceptable accuracy for major ions and metals. The only exceptions were that, as discussed previously, Barringer showed unacceptable accuracy for zinc where as AccuLabs showed unacceptable accuracy for sulfate. These results confirm that the spike sample contained the appropriate concentrations of constituents as reported by the preparing laboratory.

The accuracy results for uranium and gross alpha confirmed the previous results that Barringer had unacceptable accuracy for analyzing gross alpha. The spike sample contained a known amount of natural uranium (0.04 mg/l). Both laboratories had acceptable accuracy detecting all the uranium concentration in the sample. This spike sample did not include any other radionuclide; therefore, uranium was the only alpha-emitting radionuclide. The known amount of uranium (0.04 mg/l) in this sample generates 27.08 picoCuries per liter (pCi/l) gross alpha activity.

Results of the analyses showed that Barringer did detect uranium but the reported gross alpha activity was consistently low resulting in unacceptable accuracy. On the other hand, AccuLabs detected the correct level of gross alpha activity (approximately 25 pCi/l). This suggests that Barringer had an analytical error for the gross alpha analyses.

Laboratory Precision

Precision describes the ability of a laboratory to successively repeat an analysis of a given sample and produce identical results. Precision was determined for Barringer through the use of spike sample replicates and ground water sample replicates. Ideally, a laboratory with perfect precision would produce identical results for all replicates.

Quantification of the statistical spread of replicate values for each constituent is necessary to quantify the precision of laboratory performance. The statistical measure of data spread is the normalized standard deviation, which is known as the coefficient of variation (CV). The CV is calculated as the standard deviation divided by the mean (average value) and multiplied by 100 (i.e., the standard deviation as a percentage of the mean). This normalizing procedure allows comparison of data spread regardless of the magnitude of the reported values.

Although no absolute standard for precision exists in the literature, the comparison of CV values between analytes indicates relative levels of precision. The smaller the CV value, the higher the level of precision relative to other analytes.

Results of Evaluation

CV values were calculated for both spike sample replicates and ground water sample replicates. Table 2.7 presents the analytical results and calculated CV values for the spike sample replicates and ground water sample replicates.

The statistical evaluation of precision depends on the existence of measurable quantities of analytes. If an analyte is nondetect in all cases of analyses, then the statistical evaluation of precision cannot be made.

Calculated CV values shown in Table 2.7 indicate that Barringer demonstrated adequate precision for most major ions and metals. For example, the calculated CV values for both the spike replicate and ground water replicate samples were close to or less than 1.0. The higher CV value for zinc reported for the spike replicate samples and the values for silica, calcium, mercury, sulfate, iron, and zinc for the ground water replicate samples indicate lower precision as compared to the low CV values reported for the remaining major ion and metal constituents.

The CV values for the radionuclides are consistently higher than the values for the major ion and metals constituents. This lower level of precision

is normal for radionuclide analysis and is reflected as the counting error at the 95 percent confidence level. For example, the counting error for gross alpha was 4 and 5 for the spike replicates and 24 and 26 for the ground water replicates.

The spike sample replicates provide information that may also be used to relate the laboratory's precision to accuracy. A laboratory can provide acceptable precision for a given constituent while producing inaccurate results. In this case, the acceptable precision that is derived from inaccurate results is misleading. For example, Table 2.7 shows that Barringer achieved an acceptable precision for zinc for spike replicate samples, as indicated by a low CV value (4.81). However, accuracy for the analyses of these samples was unacceptable with RPDs greater than 20 percent. Therefore, although Barringer had acceptable precision for analysis of zinc, the actual concentrations are not correct.

Field and Trip Blank Samples

The results of the analyses of the field and trip blanks were used to determine whether field sample handling, sample transport, laboratory sample handling, or analytical methods affected the accuracy of the analytical results. Table 2.8 lists the results of the analyses for the field and trip blanks. Nondetect and zero values are shaded.

As shown in Table 2.8, most of the constituent concentrations for both the field and trip blanks were close to or below the detection limit. Ideally, the analyses of these blank samples should yield nondetectable concentrations for these analytes. However, several analytes such as specific conductivity, alkalinity, TDS, and sulfate were reported in much higher concentrations in the trip blank than in the field blank. This discrepancy suggests that the deionized water used for the trip blank was not as pure as that used for the field blank.

The presence and similarity of detectable concentrations of zinc in both the field and trip blanks are of interest because they may indicate a potential source of contamination for this constituent. This contamination

may be the cause of the unacceptable accuracy performance for the zinc analysis discussed previously. The source of the contamination is believed to be the environment, but future analyses should include an extra margin of care in sample handling and preparation and analytical procedures.

2.3.3 Summary of Results

In summary, the results of the laboratory QA/QC evaluation indicate that, except for zinc and gross alpha, the laboratory has acceptable accuracy and precision for analysis of constituents monitored for the Permit. If the laboratory had performed poorly in analyzing the constituents such as uranium or iron that were reported in concentrations exceeding the MGLs, then the laboratory accuracy and precision could be considered as another cause of the exceedances. However, since the laboratory accuracy and precision was unacceptable only for constituents that were not reported in concentrations exceeding the MGLs, laboratory performance is not considered to be a cause of the exceedances in the well water samples.

2.4 Task 4 - Review of Standards

The MGLs for the Hermit Mine site were reviewed to evaluate their appropriateness to ground water conditions at the site. Of particular concern were the standards applied to the radionuclides, since they are present in the highest concentrations in the spike water. Four main concerns related to the radionuclide standards are:

1. Application of standards to gross alpha and gross beta activity, which are used to screen for the presence of alpha- and beta-emitting radionuclides;

2. Establishment of radionuclide standards based on the reported values without consideration of the counting error;

3. Comparison of reported radionuclide values to the standards without consideration of the counting error; and

4. Application of a standard for gross beta when no man-made radionuclides are present on-site.

These concerns are addressed in the following sections.

2.4.1 Gross Alpha/Gross Beta Screening

Analysis for gross alpha and gross beta activity is used as a screening process to indicate the presence or absence of alpha- and/or beta-emitting radionuclides in water samples. As stated in the analytical procedures [American Public Health Association (APHA), 1976], "The method is a screening technique for monitoring drinking water supplies for alpha and beta particle activities according to the limits set forth under the Safe Drinking Water Act, PL 93-523, 40 FR 34324, and thereby determining the necessity for further analysis" (emphasis added). The necessity for further analysis of the alpha and beta-emitting radionuclides such as radium and strontium is based on the levels of alpha and beta activities determined from the screening. For example, Section 141.26(a)(ii) of the National Interim Primary Drinking Water Regulations requires analysis of radium-226 if the gross alpha activity measured by the screening exceeded 5 pCi/l.

Since more than eight alpha-emitting radionuclides and eight beta-emitting radionuclides (both natural and man-made) exist, the screening allows the identification of pertinent radionuclides without analyzing for each one individually. After the alpha- and beta-emitting radionuclides have been identified, monitoring for gross alpha and gross beta activities is no longer necessary because they can be calculated from the analyses of the individual radionuclides.

Calculation of the gross alpha and gross beta activities from the radionuclide concentrations provides a more accurate estimate of the activity levels than the screening. The screening analysis is not designed to be accurate, rather it is used to provide an indication of the types of radionuclides present in a sample of water. Also, as stated in the analytical procedure description (APHA, 1976), the accuracy of the procedure is

limited by the concentration of TDS in the water sample especially when the concentrations of the radioactivity in the sample are low as is the case for the well water at the Hermit Mine site. Look at the septic tank water for the actual radioactivity in the R/M well

For the Hermit Mine site, gross alpha and gross beta activities are currently being monitored in accordance with the Permit requirements. However, monitoring of only the radionuclides is recommended. Gross alpha and gross beta activities can be calculated from the radionuclide analytical results and, therefore, will be monitored by monitoring the radionuclides. Since the activity levels are determined by the concentration of radionuclides in the water, monitoring and establishing standards for the cause (radionuclide concentrations) rather than the effect (gross alpha and gross beta activities) provides a more accurate assessment of the quality of water.

2.4.2 Radionuclide Standards

Currently, the MGLs established for radionuclides under the Permit are based on the reported values without considering the counting error. The counting error indicates the range of the value reported at the 95 percent confidence level. For example, if the gross alpha activity for a water sample is reported to be 44 pCi/l with a counting error of $\pm$ 18 pCi/l, the actual value of the activity ranges from 26 pCi/l to 62 pCi/l. Due to the error inherent in radionuclide analysis, the activity cannot be reported as a single value but rather as a range of values.

Revision to the MGLs for the radionuclides is recommended to account for the counting error. Rather than assigning a single value to the MGLs, the MGLs could be reported as a range that includes the mean of the counting error plus two standard deviations. For example, the current MGL for gross alpha is 83.9 pCi/l. This value is calculated from the mean of the Pre-Mining reported values (20.4 pCi/l) plus two standard deviations (63.52 pCi/l). The mean of the counting error for these samples (19.6 pCi/l) plus two standard deviations (6.7 pCi/l) results in a counting error of $\pm$ 26.3 pCi/l. The revised gross alpha MGL would then range from 57.6 pCi/l (83.9 pCi/l minus 26.3 pCi/l) to 110.2 pCi/l (83.9 pCi/l plus 26.3 pCi/l).

Using the above procedure, the recommended radionuclide MGLs are listed as follows:

Analyte	MGL
Gross alpha	57.6 - 110.2 pCi/l
Thorium-230	0.2 - 1.8 pCi/l
Radium-226	3.5 - 5.2 pCi/l

MGL should be 20 pCi/L

2.4.3 Comparison to Standards

Currently, reported radionuclide values from each sample collection event are compared to the MGLs to determine whether they exceed the standard. However, this procedure does not account for the analytical error. Therefore, a different procedure for comparing reported values to the MGLs is recommended.

In the National Interim Primary Drinking Water regulations, Sections 141.26(a)(1) and 141.26(b)(4)(i), the EPA states that compliance with the standards shall be based on "...the average of the analyses of four samples obtained at quarterly intervals." By averaging the reported values analyzed over a one-year period, the inherent variability of the analytical results is accounted for.

Therefore, rather than comparing the reported values from each sample collection event to determine whether the site is in compliance, the mean of the reported values from at least four quarterly analyses should be compared to the MGLs. For example, the mean of the reported gross alpha values during the Mining period (four quarterly samples) was 36.8 pCi/l. In accordance with the federal regulations, this mean value rather than the values from the individual sample collection events would be compared to the MGLs to determine compliance.

Another approach would be to add the counting error to the reported values for each sample collection event and compare the resulting range of values to the recommended MGLs listed in Section 2.4.2. For example, the gross

alpha activity reported for the June 1989 sample collection event was 28 ± 21 pCi/l or ranged from 7 pCi/l to 49 pCi/l. This range would then be compared to the recommended MGL of 57.6 pCi/l to 110.3 pCi/l to determine compliance.

2.4.4 Gross Beta Standard

A standard for gross beta is normally not applied unless man-made radionuclides are present that can be identified as the source of the gross beta activity. For example, in the National Interim Drinking Water regulations, the maximum contaminant levels (Section 141.16) and monitoring frequency (Section 141.26) are established for "...beta particle...activity from man-made radionuclides in drinking water..." (emphasis added). Since no man-made radionuclides are present at the Hermit Mine site, establishing a gross beta activity is not appropriate.

AGREE

3.0 CLOSING REMARKS

This report presents the water quality data evaluation that was conducted to identify potential causes of exceedances of the MGLs for water samples collected from the Hermit Mine site monitoring well. The focus of the evaluation was to identify factors such as sample collection procedures or analytical error that could cause the exceedances. In addition, the MGLs were evaluated to determine their appropriateness for the radionuclide analytes.

3.1 Conclusions

The major findings of this report are as follows:

1. Evaluation of the existing water quality data showed that the quality of the water in the mine was similar to that in the well. The only exceptions were the radionuclides, nitrate, and arsenic which were present in much higher concentrations in the mine than in the well, and iron and manganese which were reported in lower concentrations in the mine than in the well.

2. The existing water quality data provides evidence that the exceedances in the well were not caused by seepage from the mine. This conclusion is based on two contrasting arguments as follows:

   - o If communication between the mine and the aquifer existed, then the constituents present in the mine water in highest concentrations as compared to the well water would be expected to cause increased concentrations and exceedances of these same constituents in the well water after mining operations commenced. However, the constituents in the highest concentrations in the mine water, the radionuclides, nitrate, and arsenic, exhibited only erratic exceedances of the MGLs (the radionuclides) were present in concentrations below the detection limit (nitrate), or were present in concentrations

below the MGLs (arsenic) throughout the Mining and Post-mining periods.

Also, concentrations of uranium did exhibit a trend of increasing concentrations, but this trend began during the Pre-mining period prior to commencement of mining operations. If mine seepage was the cause of the increased concentrations of uranium, the trend of increasing concentrations could not begin until after mining operations commenced. Therefore, a source other than seepage from the mine must be causing the exceedances in the well water.

- o A contrasting argument is presented for two constituents, iron and manganese, which were reported in lower concentrations in the mine water than in the sump water. In this case, assuming that communication exists between the mine and the aquifer, the concentrations of iron and manganese in the well would not be expected to increase or be present in concentrations exceeding the MGLs because concentrations in seepage from the mine would be too low to cause such a change. However, after mining operations commenced, concentrations of iron and manganese exceeded the MGLs in 60 to 100 percent of the samples. Therefore, since the mine water could not contribute sufficient concentrations of iron and manganese to cause these exceedances, a source other than mine seepage must be the cause of the exceedances in the well water.

3. The existing water quality data provide evidence that sediment in the well water is one of the causes of the exceedances of the MGLs. The sediment load in the samples of well water increased during the Pre-mining period and remained at the higher levels through the Mining and into the Post-mining periods. Increases in concentrations of constituents such as uranium, iron, and manganese coincided with the increased sediment in the water and also remained at the higher levels into the Mining and Post-mining.

Also, the concentrations of dissolved and total uranium differed by as much as an order of magnitude. These concentrations would be similar if low levels of sediment or suspended solids were in the well water.

4. Insufficient purge volume prior to sample collection is another cause of the inconsistent exceedances in the existing water quality. Improvement in the water quality was evident for samples collected during this evaluation when three casing volumes were purged prior to sample collection. Previously, only one casing volume was purged from the well prior to sample collection, and this volume was apparently insufficient to remove all the stagnant water in the well.

5. Analytical accuracy and precision is not an important factor causing the exceedances in water quality. Performance of the analytical laboratory was acceptable for all constituents except zinc and gross alpha. These constituents were not reported in concentrations exceeding the MGLs in the past, and the laboratory exhibited acceptable accuracy and precision for the remaining analytes including those reported in concentration exceeding the MGLs in the well water.

6. Water quality standards (MGLs) are inappropriately applied to the radionuclides for the following reasons:

   - First, the analytical procedure for gross alpha and gross beta activity is a screening technique to identify the presence of alpha- and beta-emitting radionuclides in the water. Continued monitoring of the gross alpha and gross beta activities is unnecessary because the radionuclides, from which they originate, are already being monitored. Since the activity levels are a function of the concentrations of the radionuclides in the water, monitoring and establishing standards for the cause (radionuclide concentrations) rather than the effect (gross alpha and gross beta

activities) provides a more accurate assessment of the quality of the water.

- o Also, a standard is in appropriately applied to gross beta since no man-made radionuclides were used on-site.

- o Finally, the current MGLs do not take into account the counting error, and comparison of the data collected to the MGL does not include the counting error. Revisions to the MGLs should include counting error.

3.2 Recommendations

The following recommendations have been developed to improve the reliability of the water quality data generated for the monitoring program required by the Permit.

1. Purge a minimum of three casing volumes prior to sampling the well.

2. Monitor the indicator parameters, pH, specific conductivity, and temperature during the purging process. A difference of 10 percent or less between measurements taken at the beginning and end of the third casing volume purge will indicate that an adequate volume has been purged.

3. Order reanalysis of any constituents that are reported in concentrations exceeding the standards to minimize the exceedances that may be related to laboratory error.

4. Institute a field and laboratory QA/QC evaluation on an annual basis to minimize and identify potential problems with the sampling or analytical procedures.

5. Eliminate gross alpha and gross beta from the list of constituents monitored under the Permit.

Respectfully submitted,

Roman S. Popielak
Senior Technical Manager

RSP/vv

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REFERENCES

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TABLES

TABLE 1.1

SUMMARY OF WATER QUALITY DATA
HERMIT MINE SITE MONITORING WELL

Analyte	Maximum Groundwater Limit	Mining				Post-Mining					
		HER 044 6/29/89	HER 048 9/21/89	HER 051 Septic 10/19/89	HER 052 12/07/89	HER 061 3/29/90	HER 64 4/27/90	HER 065 5/31/90	HER 066 6/30/90	HER 069 7/31/90	HER 070 8/31/90
pH (pH unit)	6.85	NT	6.92	NT	7.29	6.98	8.06	7.15	7.10	7.28	6.69
Spec. Cond. (umhos/cm)	3555	NT	3470	5760 3600	3470	3330	3318	3234	3400	3261	3360
Alkalinity	161	NT	150	479 NT	155	149	170	162	154	152	165
Carbonate	0	NT	NT	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<0.1	0.0
Bicarbonate	161	NT	150	150	155	149	170	162	154	152	165
Chloride	44	NT	40	39	52	38	41	38	43	39	40
TDS	3615	NT	3440	4720 3220	3310	3430	3320	3380	3440	3540	3390
TSS	107	NT	NT	NT	NT	59	93	42	44	67	NT
Nitrate as N	0.8	0.30	<0.1	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate as P	0	NT	<0.1	<0.01	<0.01	0.2	0.3	<0.1	<0.1	0.2	0.3
Sulfate	2425	NT	2280	2100 2280	2280	2290	1150	2240	2310	2250	2300
Silica	14.3	NT	11.5	9.8	8.9	13.6	13.3	12.9	10.4	14.3	NT
Calcium	630	NT	542	475 547	466	609	610	578	592	632	549
Magnesium	199	NT	186	201	155	186	186	188	193	211	178
Potassium	28.7	NT	24.2	42.5 31.6	44.5	24.2	22.5	21.7	23.5	22.7	20.7
Sodium	85.7	NT	76.0	841 102.0	NT	72.6	82.6	76.3	81.9	82.6	70.7
Flouride	1.53	NT	1.28	1.43	1.30	1.40	1.4	1.20	1.20	NT	1.40
Arsenic	0.024	0.004	0.008	0.007 0.022	0.008	0.003	<0.001	0.003	<0.01	0.001	<0.001
Barium	0.06	0.020	0.02	0.01	0.02	0.03	0.01	0.01	0.02	<0.01	0.17
Cadmium	0.027	0.006	<0.005	<0.005	<0.005	0.009	0.007	<0.005	0.009	<0.005	<0.005
Chromium	0.21	NT	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.04	0.02	<0.01	<0.01	0.02	0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	11.21	12.0	11.6	0.45 4.71	1.13	13.5	13.2	11.7	0.97	12.7	12.4
Lead	0.16	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese	0.19	0.23	0.49	0.29 0.39	0.25	0.22	0.18	0.17	0.53	0.17	0.19
Mercury	0.002	<0.0002	<0.0002	<0.0002	0.0002	0.0003	<0.0002	<0.002	<0.0002	<0.0002	<0.0002
Silver	0.03	<0.01	<0.01	<0.01	NT	0.01	<0.01	<0.01	0.01	<0.01	<0.01
Selenium	0.043	0.02	0.009	0.023	0.006	<0.001	<0.001	<0.002	<0.005	0.002	<0.002
Zinc	0.189	0.077	<0.005	0.572 0.013	NT	0.028	<0.005	<0.005	NT	<0.005	0.009
Gross Alpha (pCi/l)	84	28	19	195 ±40 78	22	21	44	52	22	14	10
Gross Beta (pCi/l)	43	40	41	110 ±20 54	68	40	35	46	25	13	43
Radium-226 (pCi/l)	4.4	NT	3.3	0.8	2.4	36.0	2.0	2.6	4.3	5.2	2.6
Radium-228 (pCi/l)	--	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Thorium-230 (pCi/l)	1	NT	0.2	0.0	3.1	0.0	1.0	0.0	0.5	0.9	0.1
Natural Uranium	0.003	0.0035	0.0041	0.039 0.0064	0.0240	0.0036	0.0080	0.0057	0.0027	0.0042	0.0085

U is a magnitude higher (39 ppb) in septic than in "monitoring well"

Maybe there is extra 0 between decimal point and results for U?
It would explain why the results are in gray

Notes:
1. Sample analytical results for total concentrations except where values are boxed. Boxed values are dissolved concentrations.
2. Concentrations report in mg/l except where noted.
3. Shaded values exceed the Maximum Groundwater Limits established in accordance with the Permit.
4. NT = Not tested.

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TABLE 2.1

EXISTING WATER QUALITY DATA
HERMIT MINE SITE

Analyte	Maximum Groundwater Limit	Mining							Post-Mining						
		Well HER 044 6/29/89	Sump HER 043 6/29/89	Well HER 048 9/21/89	Sump HER 049 9/21/89	Well HER 051 10/19/89	Well HER 052 12/07/89	Sump HER 054 12/07/89	Well HER 061 3/29/90	Sump HER 059 3/29/90	Well HER 064 4/27/90	Well HER 065 5/31/90	Well HER 066 6/30/90	Well HER 069 7/31/90	Well HER 070 8/31/90
pH (pH unit)	6.85			6.92	6.69		7.29	7.35	6.98	7.74	8.06	7.15	7.1	7.28	6.69
Spec. Cond. (umhos/cm)	3555			3470	3820	3600	3470	3410	3330	3190	3318	3234	3400	3261	3360
Alkalinity	161			150	116		155		149	196	170	162	154	152	165.1
Carbonate	0					<1.0	<0.5	<0.5	<1.0		<1.0	<1.0	<1.0	<0.1	0.0
Bicarbonate	161			150	116	150	155	218	149	196	170	162	154	152	165.3
Chloride	44			40	38	39	52	30	38	30	NT	38	43	39	40
TDS	3615			3440	3530	3220	3310	3450	3430	3290	3320	3380	3440	3540	3390
TSS	107								59	11	93	42	44	67	NT
Nitrate as N	0.8		12.8	<0.1	31.4	<0.1	<0.1	51.3	<0.1	6.0	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate as P	0			<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	0.3	<0.1	<0.1	0.2	0.3
Sulfate	2425			2280	2300	2280	2280	2250	2290	2180	1150	2240	2310	2250	2300
Silica	14.3			11.5	11.2	9.8	8.9	10.1	D	9.9	D	D	D	D	NT
Calcium	620			542	521	547	466	537	D	513	D	D	D	D	549
Magnasium	199			186	187	210	155	170	D	168	D	D	D	D	178
Potassium	28.7			24.2	36.1	31.6	44.5	31.8	D	27.5	D	D	D	D	20.7
Sodium	85.7			76	97.8	102	NT	82	D	76.6	D	D	D	D	70.7
Flouride	1.53			1.28	1.35	1.43	1.3	1.3	1.4	1.1	1.4	1.2	1.2	D	1.4
Arsenic	0.024	0.004	1.09	0.008	0.530	0.022	0.008	0.205	D	0.266	D	D	D	D	<0.001
Barium	0.06	0.02	0.03	0.02	0.01	0.01	0.02	0.02	D	<0.01	D	D	D	D	0.17
Cadmium	0.027	0.006	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	D	<0.005	D	D	D	D	<0.005
Chromium	0.21			<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.04	0.02	0.04	<0.01	0.02	<0.01	0.02	0.03	D	<0.01	D	D	D	D	<0.01
Iron	11.21	12.0	0.29	11.6	0.25	4.71	1.13	0.19	D	0.11	D	D	D	D	12.4
Lead	0.16	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	0.03	D	0.04	D	D	D	D	<0.02
Manganese	0.19	0.23	0.08	0.49	0.08	0.3900	0.25	0.06	D	0.04	D	D	D	D	0.19
Mercury	0.002	<0.0002	0.0002	0.009	<0.0002	<0.0002	0.0002	0.0005	D	<0.0002	D	D	D	D	<0.0002
Silver	0.03	<0.01	<0.01	<0.0002	0.02	0.0230			D	0.01	D	D	D	D	<0.002
Selenium	0.043	0.020	0.042	<0.01	0.017	<0.01	0.006	0.010	D	0.008	D	D	D	D	<0.01
Zinc	0.189	0.077	0.123	<0.005	0.156	0.013	NT	0.093	D	0.094	D	D	D	D	0.009
Gross Alpha (pCi/l)	84	28	4000	19	29800	78	22	104000	21	5500	44	52	22	14	10
Gross Beta (pCi/l)	43	40	1100	41	10100	54	68	44900	40	1190	35	46	25	13	43
Radium-226 (pCi/l)	4.4			3.3	60	0.8	2.4	7800	36	210	2.0	2.6	4.3	5.2	2.6
Radium-228 (pCi/l)	-														
Thorium-230 (pCi/l)	1.0			0.2	710	0.0	3.1	5900	0.0	0.5	1.0	0.0	0.5	0.9	0.1
Natural Uranium	0.003 0.030	0.0035	3.31	0.0041	18.4	0.0064	0.0240	36.6	0.0036	4.29	0.0080	0.0057	0.0027	0.0042	0.0085

Notes:
1. Sample analytical results for total concentrations except where noted.
2. Concentrations report in mg/l except where noted.
3. Shaded values exceed the Maximum Groundwater Limits established in accordance with the Permit.
4. NT = Not tested.
5. D = Analyzed for dissolved concentrations.

TABLE 2.2

CONCENTRATIONS OF TOTAL SUSPENDED SOLIDS
HERMIT MINE SITE MONITOR WELL

Pre-Mining

Sample	Date	Concentration (mg/l)
HER-012	4/28/88	18
HER-025	6/29/88	14
HER-032	12/23/88	9
Jan-Feb 1989: EFN personnel first observed sediment in water, red color		
HER-041	5/31/89	88

Post-Mining

HER-061	3/29/90	59
HER-064	4/27/90	93
HER-065	5/31/90	42
HER-066	6/30/90	44
HER-069	7/31/90	67

TABLE 2.3

EXCEEDANCES RELATED TO PURGE VOLUME

Purge Volume / Analytes	3 Casings: Number of MGL Exceedances/Total Number of Analyses	1 Casing: Number of MGL Exceedances/Total Number of Analyses
pH	0/3	0/5
Spec.Cond.	0/3	1/9
Alkalinity	0/3	3/8
Carbonate	0/3	0/6
Bicarbonate	0/3	3/9
Chlorite	0/3	1/8
TDS	0/3	0/9
TSS	0/3	5/5
Nitrate-as N	0/3	0/9
Phosphate-as P	0/3	4/9
Sulfate	0/3	0/9
Silica	0/3	0/3
Calcium	0/3	0/4
Magnesium	0/3	1/4
Potassium	0/3	2/4
Sodium	0/3	1/3
Fluoride	0/3	0/8
Arsenic	0/3	0/5
Barium	0/3	1/5
Cadmium	0/3	0/5
Chromium	0/3	0/9
Copper	0/3	0/5
Iron	0/3	3/5
Lead	0/3	0/5
Manganase	0/3	4/5
Mercury	0/3	0/5
Silver	0/3	0/4
Selenium	0/3	0/5
Zinc	0/3	0/4
Gross Alpha	0/3	0/10
Gross Beta	2/3	3/10
Radium-226	0/3	2/9
Radium-228		
Thorium-230	0/3	1/9
Natural Uranium	0/3	9/10

Notes:

1. Analytes with exceedances of the MGLs are shaded.
2. MGL is the Maximum Groundwater Limit established in accordance with the Permit.

TABLE 2.4

ANALYTES FOR LABORATORY QA/QC PROGRAM

Analytes	Sample Type: Spike and Spike Replicates	Sample Type: Ground Water Replicates	Sample Type: Blank
Major Ions			
pH		X	X
Spec.Cond.		X	X
Alkalinity		X	X
Carbonate		X	X
Bicarbonate		X	X
Chloride	X	X	X
TDS	X	X	X
TSS		X	X
Nitrate-as N		X	X
Phosphate-as P		X	X
Sulfate	X	X	X
Silica		X	X
Calcium		X	X
Magnesium		X	X
Potassium	X	X	X
Sodium	X	X	X
Fluoride		X	X
Metals			
Arsenic		X	X
Barium		X	X
Cadmium		X	X
Chromium	X	X	X
Copper		X	X
Iron	X	X	X
Lead		X	X
Manganase	X	X	X
Mercury		X	X
Silver		X	X
Selenium		X	X
Zinc	X	X	X
Radionuclides			
Gross Alpha	X	X	X
Gross Beta		X	X
Radium-226		X	X
Radium-228		X	X
Thorium-230		X	X
Natural Uranium	X	X	X

TABLE 2.5

SPIKE SAMPLE RESULTS FOR ACCURACY ASSESSMENT

	Unit of Measure	Spike Value	Spike Sample No.1 (HER 078) Reported Value	Spike Sample No.1 (HER 078) RPD	Spike Sample No.2 (HER 079) Reported Value	Spike Sample No.2 (HER 079) RPD	Spike Sample No.3 (HER 080) Reported Value	Spike Sample No.3 (HER 080) RPD
Major Ions								
Chloride	mg/l	50.00	52.00	4.0	53.00	6.0	53.00	6.0
TDS	mg/l	1562.00	1500.00	4.0	1490.00	4.6	1490.00	4.6
Sulfate	mg/l	1000.00	1040.00	4.0	1020.00	2.0	1030.00	3.0
Potassium	mg/l	50.00	46.80	6.4	45.40	9.2	45.90	8.2
Sodium	mg/l	100.00	100.00	0.0	97.60	2.4	97.10	2.9
Metals								
Chromium	mg/l	0.10	0.10	0.0	0.10	0.0	0.10	0.0
Iron	mg/l	10.00	9.32	6.8	9.11	8.9	9.15	8.5
Manganase	mg/l	0.30	0.33	10.0	0.32	6.7	0.33	10.0
Zinc	mg/l	0.25	0.343	100.0	0.327	100.0	0.360	100.0
Radionuclides								
Gross Alpha	pCi/l	27.08	13 +/- 5	52.0	15 +/- 4	44.6	15 +/- 4	44.6
Natural Uranium	mg/l	0.0400	0.0396	1.0	0.0385	3.8	0.0382	4.5

Notes:

1. RPD = Relative percent difference.
2. Shaded values are unacceptable accuracy.

TABLE 2.6

COMPARISON OF LABORATORY ACCURACY

	Unit of Measure	Spike Value	AccuLabs Reported Value	AccuLabs RPD	Barringer Reported Value	Barringer RPD
Major Ions						
Chloride	mg/l	50.00	54.00	8.00	52.67	5.33
TDS	mg/l	1562.00	1500.00	3.97	1493.33	4.40
Sulfate	mg/l	1000.00	700.00	30.00	1030.00	3.00
Potassium	mg/l	50.00	51.00	2.00	46.03	7.93
Sodium	mg/l	100.00	93.00	7.00	98.23	1.77
Metals						
Chromium	mg/l	0.10	0.10	0.00	0.10	0.00
Iron	mg/l	10.00	9.10	9.00	9.19	8.07
Manganase	mg/l	0.30	0.33	10.00	0.33	8.90
Zinc	mg/l	0.25	0.280	100.00	0.343	37.33
Radionuclides						
Gross Alpha	pCi/l	27.08	26.5	2.14	14.3	47.07
Natural Uranium	mg/l	0.0400	0.046	15.0	0.0388	3.10

Notes:

1. RPD = Relative percent difference.
2. Shaded values represent unacceptable accuracy.
3. Reported value for Barringer is the average of the three replicate sample values listed in Table 2.5.

TABLE 2.7

REPLICATE SAMPLE RESULTS USED IN
PRECISION EVALUATION

	Spike Sample Replicates								Ground Water Sample Replicates							
	HER 078		HER 079		HER 080		CV		HER 073		HER 074		HER 075		CV	
pH (pH unit)									7.38		7.38		7.45		0.55	
Spec.Cond. (umhos/cm)									3,470		3,380		3,380		1.52	
Alkalinity									161.00		161.00		157.00		1.45	
Carbonate									<1		<1		<1		NA	
Bicarbonate									161.00		161.00		157.00		1.45	
Chloride	52.00		53.00		53.00		1.10		40.00		40.00		40.00		0.00	
TDS	1500		1490		1490		0.39		3,380.00		3,360.00		3,330.00		0.75	
TSS									<4		<4		<4		NA	
Nitrate-as N									<0.1		<0.1		<0.1		NA	
Phosphate-as P									<0.1		<0.1		<0.1		NA	
Sulfate	1040.00		1020.00		1030.00		0.97		1,830.00		2,240.00		2,250.00		11.38	
Silica									13.00		12.70		13.20		1.94	
Calcium									525.00		512.00		524.00		1.39	
Magnasium									177.00		171.00		175.00		1.75	
Potassium	46.80		45.40		45.90		1.54		20.10		19.70		20.00		1.04	
Sodium	100		97.60		97.10		1.58		78.10		74.50		76.90		2.40	
Flouride									1.50		1.50		1.50		0.00	
Arsenic									0.002		0.002		0.002		0.00	
Barium									0.01		0.01		0.01		0.00	
Cadmium									<0.005		<0.005		<0.005		NA	
Chromium	0.10		0.10		0.10		0.00		<0.01		<0.01		<0.01		NA	
Copper									<0.01		<0.01		<0.01		NA	
Iron	9.32		9.11		9.15		1.21		9.47		9.29		10.40		6.13	
Lead									<0.02		<0.02		<0.02		NA	
Manganase	0.33		0.32		0.33		1.77		0.12		0.12		0.12		0.00	
Mercury									<0.0002		<0.0002		<0.0002		NA	
Silver									0.01		<0.01		0.01		NA	
Selenium									<0.002		<0.002		<0.002		NA	
Zinc	0.343		0.327		0.360		4.81		0.111		0.175		0.105		29.77	
		Error		Error		Error				Error		Error		Error		
Gross Alpha (pCi/l)	13	+/- 5	15	+/- 4	15	+/- 4	8.06		58.00	+/- 26	62.00	+/- 26	46.00	+/- 24	15.05	
Gross Beta (pCi/l)	51	+/- 4	54	+/- 4	53	+/- 4	2.90		48.00	+/- 14	35.00	+/- 13	46.00	+/- 14	16.28	
Radium-226 (pCi/l)									3.20	+/- 0.6	2.10	+/- 0.5	2.10	+/- 0.5	25.75	
Radium-228 (pCi/l)									1.50	+/- 1.3	0.80	+/- 0.8	1.60	+/- 0.8	33.53	
Thorium-230 (pCi/l)									0.00	+/- 0.5	0.40	+/- 0.6	0.20	+/- 0.5	100.00	
Natural Uranium	0.0396		0.0385		0.0382		1.90		0.0009		0.0011		0.0010		10.00	

Notes:
1. CV = coefficient of variation.
2. NA = Not applicable (precision analyses were only performed for analytes showing detectable concentrations).
3. Concentrations reported in mg/l except where noted.
4. Error is the counting error at the 95 percent confidence level.

TABLE 2.8

FIELD AND TRIP BLANK ANALYTICAL RESULTS

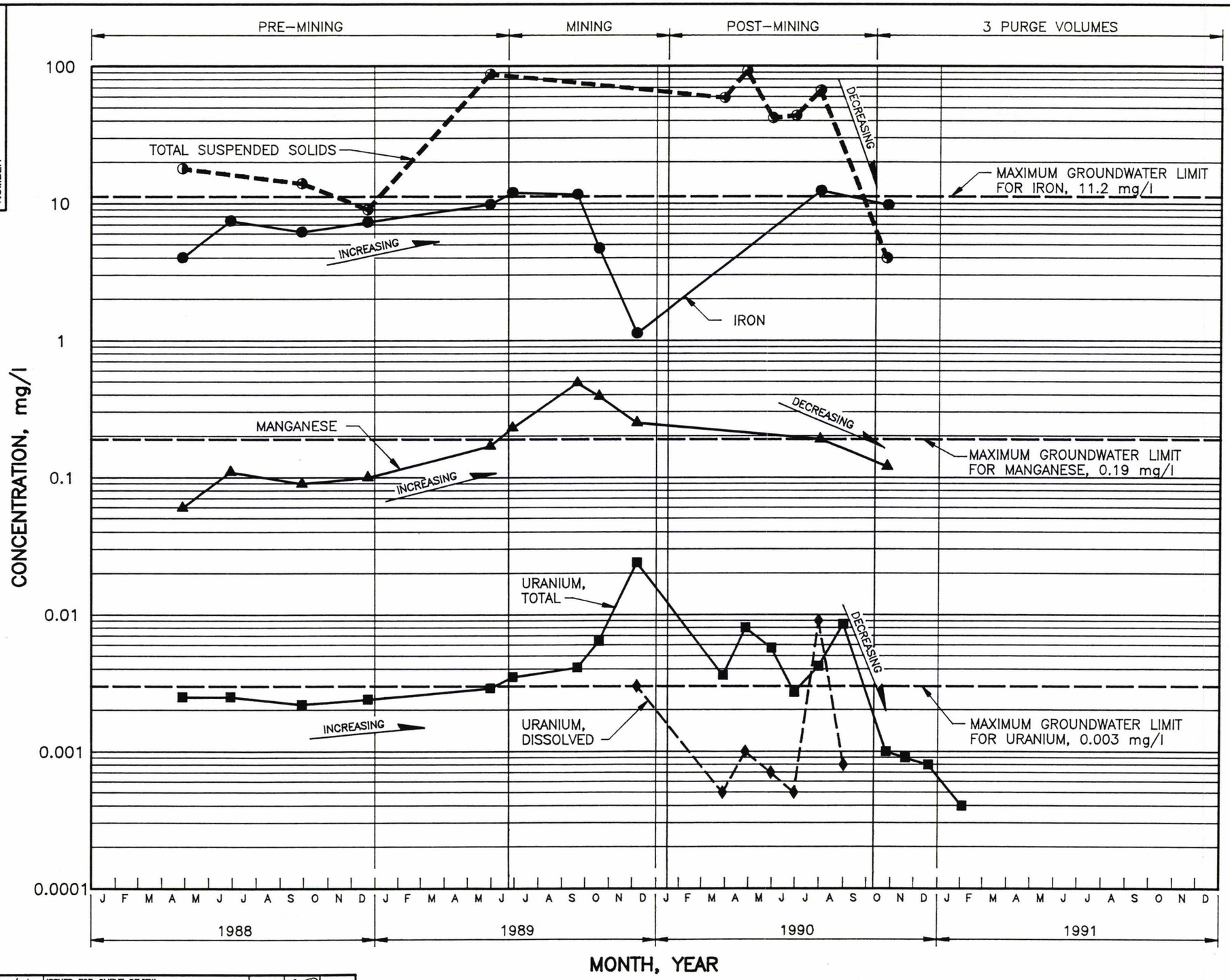
	Unit of Measure	Field Blank HER 076	Trip Blank HER 077
pH	pH unit	5.79	7.92
Spec.Cond.	umhos/cm	2.84	275.00
Alkalinity	mg/l	<1	90.00
Carbonate	mg/l	<1	<1
Bicarbonate	mg/l	<1	90.00
Chloride	mg/l	2.00	9.00
TDS	mg/l	<4	102.00
TSS	mg/l	<4	<4
Nitrate-as N	mg/l	<0.1	<0.1
Phosphate-as P	mg/l	<0.1	<0.1
Sulfate	mg/l	<4	28.40
Silica	mg/l	7.94	1.46
Calcium	mg/l	32.50	0.12
Magnasium	mg/l	8.07	0.02
Potassium	mg/l	1.70	<0.5
Sodium	mg/l	6.72	0.23
Flouride	mg/l	<0.1	0.10
Arsenic	mg/l	<0.001	<0.001
Barium	mg/l	0.04	<0.01
Cadmium	mg/l	<0.005	<0.005
Chromium	mg/l	<0.01	<0.01
Copper	mg/l	<0.01	<0.01
Iron	mg/l	0.03	0.02
Lead	mg/l	<0.02	<0.02
Manganase	mg/l	<0.01	<0.01
Mercury	mg/l	0.0007	<0.0002
Silver	mg/l	<0.01	<0.01
Selenium	mg/l	<0.002	<0.002
Zinc	mg/l	0.108	0.100
Gross Alpha	pCi/l	0.00	<0.20
Gross Beta	pCi/l	<0.90	3.20
Radium-226	pCi/l	<0.20	0.00
Radium-228	pCi/l	1.10	1.10
Thorium-230	pCi/l	0.00	0.00
Natural Uranium	mg/l	0.0008	<0.0003

Doesn't look like DI water

Note: Nondetect and zero values are shaded.

FIGURES

DRAWING NUMBER 90-275-B5



"Decreasing" is not a trend because of changed sampling conditions

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	6/3/91	ISSUED FOR CLIENT REVIEW	R.H.		

WATER QUALITY TRENDS

PREPARED FOR

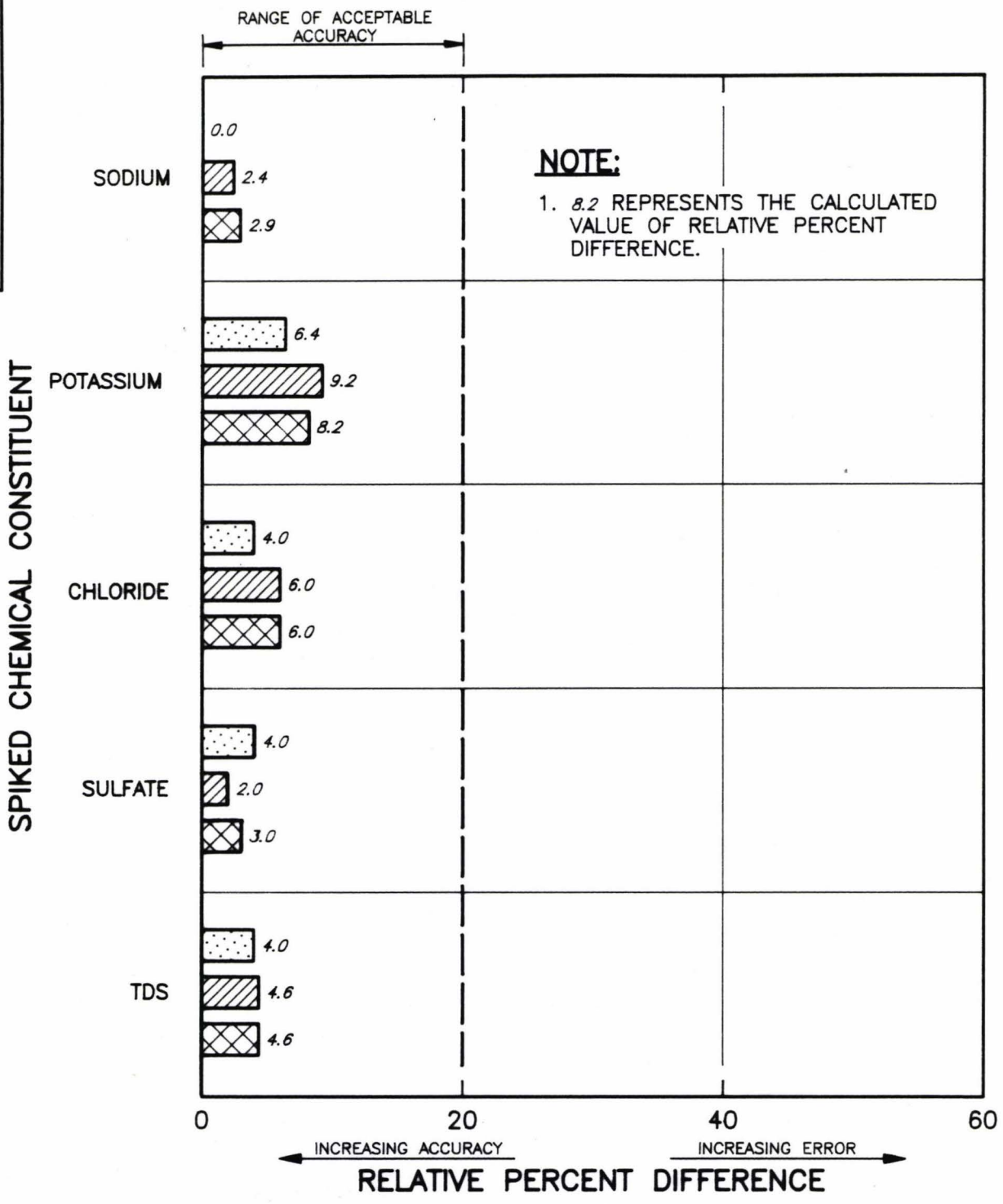
ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

CanonieEnvironmental

DATE: 4-19-91	FIGURE 2-1	DRAWING NUMBER 90-275-B5
SCALE: AS SHOWN		

1

DRAWING NUMBER 90-275-A1



NOTE:

1. *8.2* REPRESENTS THE CALCULATED VALUE OF RELATIVE PERCENT DIFFERENCE.

LEGEND:

- SPIKE REPLICATE SAMPLE NUMBER 1
- SPIKE REPLICATE SAMPLE NUMBER 2
- SPIKE REPLICATE SAMPLE NUMBER 3

LABORATORY ACCURACY BY CONSTITUENT (IONS)
HERMIT MINE SITE

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

CanonieEnvironmental

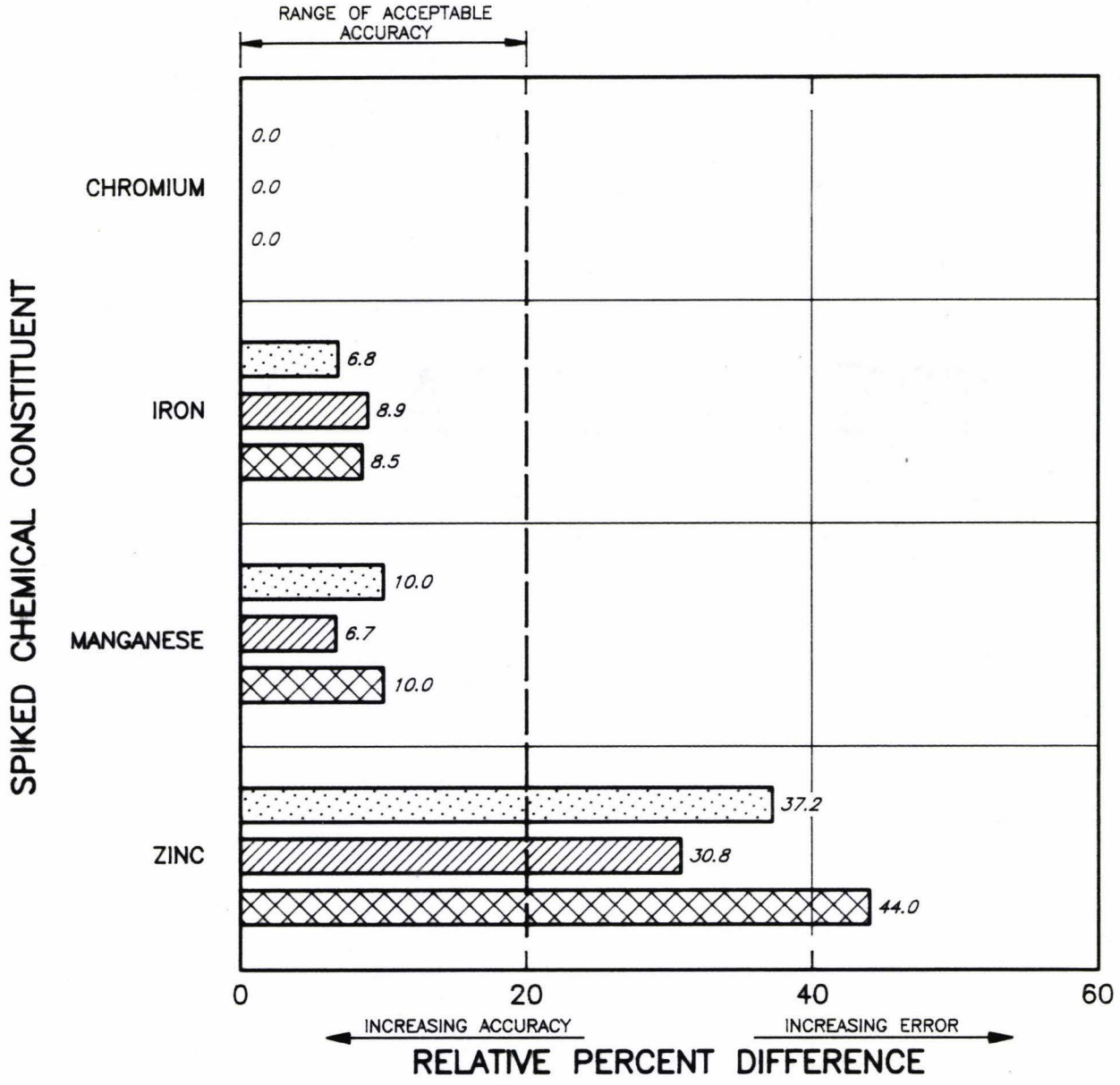
No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	6/3/91	ISSUED FOR CLIENT REVIEW	M.B.H.	[illegible]	[illegible]

DATE: 1-21-91
SCALE: AS SHOWN

FIGURE 2-2

DRAWING NUMBER 90-275-A1

DRAWING NUMBER 90-275-A2



NOTE:

1. *8.9* REPRESENTS THE CALCULATED VALUE OF RELATIVE PERCENT DIFFERENCE.

LEGEND:

- SPIKE REPLICATE SAMPLE NUMBER 1
- SPIKE REPLICATE SAMPLE NUMBER 2
- SPIKE REPLICATE SAMPLE NUMBER 3

LABORATORY ACCURACY BY CONSTITUENT (METALS)
HERMIT MINE SITE

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

CanonieEnvironmental

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	6/3/91	ISSUED FOR CLIENT REVIEW	M.B.H.		

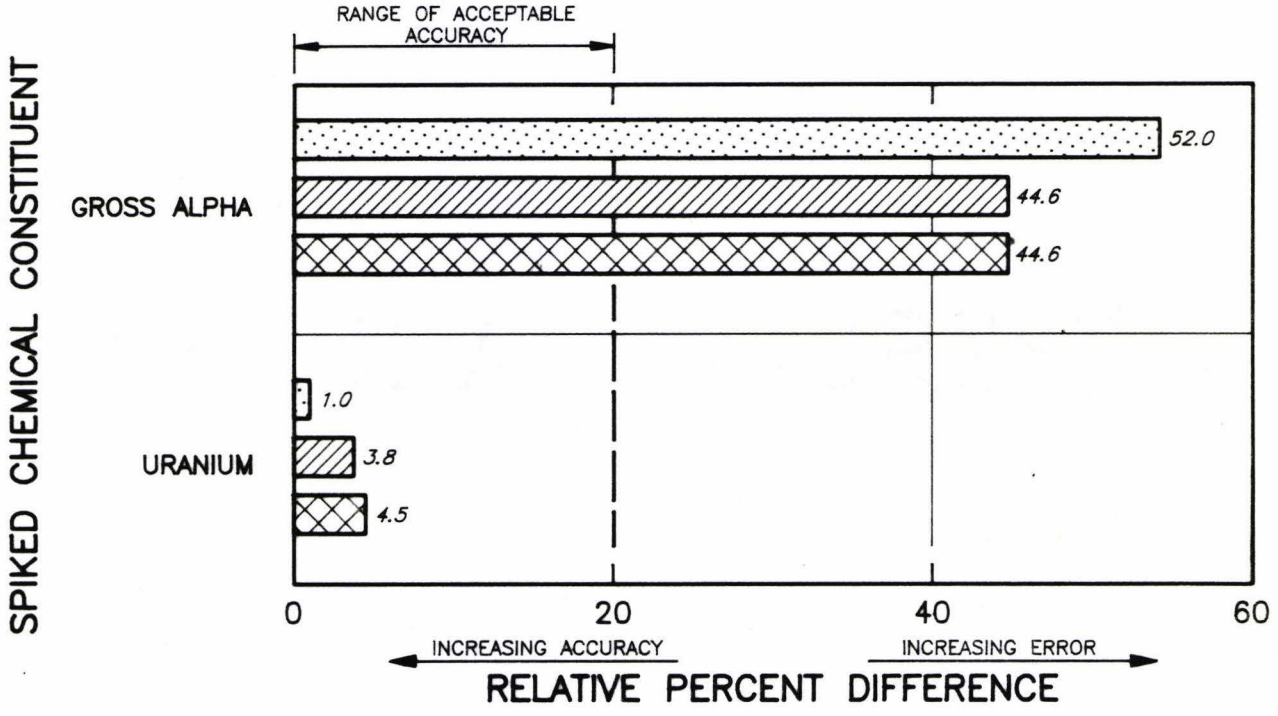
DATE: 1-21-91
SCALE: AS SHOWN

FIGURE 2-3

DRAWING NUMBER 90-275-A2

1

DRAWING NUMBER 90-275-A3



NOTE:

1. *3.8* REPRESENTS THE CALCULATED VALUE OF RELATIVE PERCENT DIFFERENCE.

LEGEND:

- SPIKE REPLICATE SAMPLE NUMBER 1
- SPIKE REPLICATE SAMPLE NUMBER 2
- SPIKE REPLICATE SAMPLE NUMBER 3

LABORATORY ACCURACY BY CONSTITUENT (RADIONUCLIDES)
HERMIT MINE SITE

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

CanonieEnvironmental

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	6/3/91	ISSUED FOR CLIENT REVIEW	M.B.H.	SHP	RJP

DATE: 1-21-91
SCALE: AS SHOWN

FIGURE 2-4

DRAWING NUMBER 90-275-A3

1

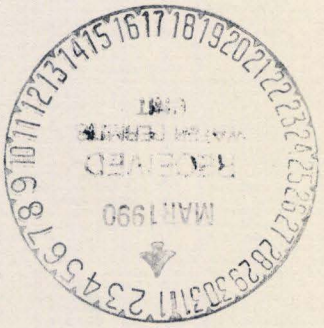
File Divider Page

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561

February 28, 1990



Ms. Abigail A. Myers
Environmental Health Specialist
Water Permits Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

Re: Pinenut Mine Groundwater Protection Permit
#G-0036-08

Dear Ms. Myers:

Enclosed please find Second, Third and Fourth Quarter analytical results for the Pinenut Mine monitor well. Also enclosed is a duplicate sample taken from the Pinenut Mine monitor well for quality control purposes and the annual analytical report for Willow Springs annual sampling.

The dates that samples were taken and sample names as they appear on laboratory analytical sheets appear below.

Second Quarter	5-31-89		PN-40
Third Quarter	6-29-89	3rd quarter?	PN-046
Fourth Quarter	12-21-89		PN-055
Pinenut Duplicate Fourth Quarter Sample	12-21-89		LC-056
Willow Springs Annual Sampling	12-28-89		WS-057

Willow Springs is draws fro the perched aquifer

Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

Analysis was performed for the comprehensive list of parameters given in Part II. B.2.b. of the Groundwater Protection Permit. Mining has not commenced at the Pinenut Mine and the facility is currently being held in a standby status. Therefore, monitoring falls into a premining phase as defined in the Groundwater Protection Permit. No significant zones of groundwater inflow to the shaft occur.

If you have any questions concerning this matter, please contact me at our Denver office.

Sincerely,

William J. Almas
Environmental Coordinator

WJA:vrc
Encl.

cc: R. A. Munson
R. B. Smith

[redacted]MIT MINE
[redacted]35-08

date--------

[redacted]ameters	Sample Frequency	Groundwater Limits (MGL)	DWR reg # 55-518877
[redacted]alinity (as CaCO3)	annually	Reserved	
[redacted]enic	quarterly	Reserved	
Barium	quarterly	Reserved	
[redacted]arbonate	annually	Reserved	
[redacted]mium	quarterly	Reserved	
Calcium	annually	Reserved	
Carbonate	annually	Reserved	
[redacted]oride	annually	Reserved	
[redacted]omium (total)	annually	Reserved	
Copper	quarterly	Reserved	
[redacted]oride	annually	Reserved	
[redacted]n	quarterly	Reserved	
Lead	quarterly	Reserved	
Magnesium	annually	Reserved	
[redacted]ganese	quarterly	Reserved	
[redacted]rcury	quarterly	Reserved	
Nitrate as N	quarterly	Reserved	
[redacted]sphate	annually	Reserved	
[redacted]assium	annually	Reserved	
Selenium	quarterly	Reserved	
[redacted]ver	quarterly	Reserved	
[redacted]ica	annually	Reserved	
Sodium	annually	Reserved	
Sulfate	annually	Reserved	
[redacted]al Dissolved Solids	annually	Reserved	
[redacted]nc	quarterly	Reserved	
Specific Conductance	annually	Reserved	
[redacted]ss Alpha	annually	Reserved	
[redacted]ss Beta	annually	Reserved	
Total Uranium	annually	Reserved	
Thorium 230	annually	Reserved	
[redacted]ium 226	annually	Reserved	

Miguel A. Santiago 12/12/88

Summary of Monitoring Results
Canyon Mine Monitor Well

(mg/l)	6/28/88	9/21/88
Alcalinity as CaCO3	204	218
HCO3 as CaCO3	204	218
CO3 as CaCO3	<1	<1
NH4(N)		<.1
As	<.001	<.001
B		.08
Ba	.10	.09
Cd	.010	.005
Ca	46.2	40.6
Cl	6.3	4.6
Cr	.03	.02
Condt. (umho/cm)	437	452
Cu	<.01	<.01
F	.34	.35
Fe	.24	.23
Pb	.04	<.02
Mg	31.1	28.2
Mn	.04	.03
Hg	.0004	.0005
Mo		<.01

Miguel A. Santiago 12/12/88

Summary of Monitoring Results
Pinenut Mine Monitor Well

(mg/l)	4/28/88	6/28/88	9/27/88
Alcalinity as CaCO3	183	173	191
HCO3 as CaCO3	183	173	191
CO3 as CaCO3	<1	<1	<1
NH4(N)	<.1		<.1
As	.003	.015	.034
B			.36
Ba	.01	.02	.02
Cd	<.005	.017	<.005
Ca	282	294	233
Cl	16	15	16.1
Cr	.07	.11	.22
Condt. (umho/cm)	2170	2140	2130
Cu	.01	.03	.51
F	0.91	.89	.87
Fe	3.42	10.0	10.6
Pb	<.02	0.11	.03
Mg	136	146	128
Mn	.32	.55	.42
Hg	.0012	.0004	.0003
Mo			.10

NO3(N)	<.1	<.1	<.1
pH (units)	8.17	6.8	7.52
PO4	<.1	<.01	<.1
K	19.0	18.9	18.7
Se	.007	.004	.024
SiO2	11.7	10.0	8.64
Ag	.01	.01	.02
Na	46.4	48.1	51.6
TDS	1970	2010	1880
TSS	14		25
SO4	1210	1290	1160
SO3			<2
Zn	.011	.127	.061
Alpha(pCi/l)	22±12	54±17	42±14
Beta "	26±8	38±7	33±7
Ra-226 "	10±1	12±1	1.9±0.5
Ra-228 "	0.5±0.8		
Th-230 "	0.5±0.5	0.9±0.7	0.5±0.5
Pb-210 "	0.4±0.7		
Po-210 "	0.4±0.4		
U(mg/l)	0.0096	0.0101	.0073

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 344 Client PO No.

Sample Type: water

Date Collected: 5/31/89 Date Received: 6/2/89 Date Reported: 7/21/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HER041	159	159	<1	.006	<.01
HER042	209	209	<1	.007	<.01
PN040	204	204	<1	<.001	.01

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance umhos/cm	Cu Total mg/l
HER041	.005	546	39.6	.01	3200	.02
HER042	.005	514	28.4	.02	3170	.02
PN040	.005	181	20.1	<.01	1860	.02

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	NO_3 as N mg/l
HER041	1.26	9.85	<.02	187	.17	.0002	<.1
HER042	1.07	1.01	<.02	166	.05	.0003	<.1
PN040	.73	8.52	<.02	127	.51	.0002	<.1

Approved by D. Fuchs

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

Sample Identification	pH units	PO_4 as P mg/l	K Total mg/l	Se Total mg/l	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l
HER041	7.59	<.1	25.7	.018	12.1	<.01	82.0
HER042	7.68	<.1	32.8	.019	9.37	<.01	134
PN040	7.84	<.1	28.9	.016	8.68	<.01	79.8

Sample Identification	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l	S mg/l	Ra-226 (Total) pCi/liter ±Precision*
HER041	3470	88	2360	.015	<2	1.2 ± 0.4
HER042	3360	<4	2190	.055	<2	230 ± 10
PN040	1610	66	1010	.036	<2	15 ± 1

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER041	14 ± 20	39 ± 11	0.0 ± 0.5	0.0029
HER042	1600 ± 100	400 ± 20	0.1 ± 0.4	0.0245
PN040	65 ± 14	44 ± 6	0.1 ± 0.4	0.0067

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN:

Client No. Log No. 634 Client PO No.

Sample Type: water

Date Collected: 6/29/89 Date Received: 7/7/89 Date Reported: 8/23/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l
PN046	199	199	<1	.002

Sample Identification	Ba Total mg/l	Cd Total mg/l	Ca Total mg/l	Chloride mg/l	Cr Total mg/l	Conductance umho/cm
PN046	.02	<.005	183	18.7	<.01	1790

Sample Identification	Cu Total mg/l	Fluoride mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
PN046	.01	.71	8.15	<.01	123	.76

Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
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Golden, CO 80401
(303) 277-1687

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN:

LGN: 634

RESULTS OF ANALYSIS (cont'd)

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	pH units	PO_4 as P mg/l	K Total mg/l
PN046	<.0002	<.1	7.50	<.1	30.7

Sample Identification	Se Total mg/l	SiO_2 Total mg/l	As Total mg/l	Na Total mg/l	TDS mg/l	SO_4 mg/l
PN046	.008	8.4	<.01	75.1	1640	1030

Sample Identification	Zn Total mg/l	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Ra-226 (Total) pCi/liter ±Precision*
PN046	.041	70 ± 16	48 ± 6	12 ± 1

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

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Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN:

LGN: 634

RESULTS OF ANALYSIS (cont'd)

Sample Identification	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
PN046	0.9 ± 0.7	0.0097

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

8-Feb-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Attn:
Project: Fredonia,AZ

Received: 9-Jan-90
Purchase order :

Job: 901794E

Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	NH4 as N mg/l	As Dissolved mg/l	Ba Dissolved mg/l	CO3 as CaCO3 mg/l
PN-055	184	<0.1	0.009	<0.01	<0.5
LC-056	184	<0.1	0.010	0.03	<0.5

Sample	Cd Dissolved mg/l	Ca Dissolved mg/l	Cl mg/l	Cr Dissolved mg/l	Specific Conductance µmho/cm	Cu Dissolved mg/l
PN-055	<0.005	172	21	<0.01	2059	<0.01
LC-056	<0.005	176	21	<0.01	2059	<0.01

Fedonia Office

Sample	F mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l	Mg Dissolved mg/l	Mn Dissolved mg/l	Hg Dissolved mg/l
PN-055	0.8	7.41	<0.02	120	0.49	0.0003
LC-056	0.8	8.66	<0.02	121	0.47	0.0002

Sample	pH unit	PO4 as P mg/l	K Dissolved mg/l	Se Dissolved mg/l	SiO2 Dissolved mg/l	Ag Dissolved mg/l
PN-055	7.18	<0.1	30.1	0.009	8.4	<0.01
LC-056	7.19	<0.1	29.7	0.010	8.7	<0.01

Sample	Na Dissolved mg/l	TDS mg/l	SO4 mg/l	Zn Dissolved mg/l	Gross Alpha Dissolved pCi/l	Error 2σ*
PN-055	79.3	1610	1010	0.009	12	±9
LC-056	78.7	1600	1020	0.016	22	±10

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

8-Feb-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Attn:
Project: Fredonia,AZ

Received: 9-Jan-90
Purchase order :

Job: 901794E

Status: Final

Sample Type: Water

Sample	Gross Beta Dissolved pCi/l	Error 2σ*	Ra-226 Dissolved pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*
PN-055	32	±6	3.7	±0.6	0.0	±0.4
LC-056	40	±6	4.1	±0.7	0.3	±0.5

Sample	U Dissolved mg/l	U Total mg/l
PN-055	0.0044	0.0059
LC-056	0.0015	0.0030

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8-Feb-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Page: 3
Copy: 1 of 3
Set : 1

Attn:
Project: Fredonia,AZ

Received: 9-Jan-90
Purchase order :

Job: 901794E

Status: Final

Abbreviations:

Analyses:

NH4 as N	: Ammonia
As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

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Denver, CO 80202

Page: 4
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Attn:
Project: Fredonia,AZ

Received: 9-Jan-90
Purchase order :

Job: 901794E

Status: Final

Abbreviations:

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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8-Feb-90

Bill Almas
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1200-17th St.
Suite 2500
Denver, CO 80202

Attn:
Project: Fredonia,AZ Purchase order :

Received: 9-Jan-90

Job: 901794E Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 1/9/90 By: T. Moncrief Via: UPS

Sample Container Type: large cube
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None 4. HaOH/ZNO Ac
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
NH4	1	350.1	.1 mg/l	2	Hobbs	1/11
F	1	340.2	.01 mg/l	3	Ryman	1/11
pH	1	150.1	.01 mg/l	3	Ryman	1/11
Cl	1	325.2	1 mg/l	3	Hobbs	1/12
Conductance	1	1201	.001 mg/l	3	Ryman	1/12
HCO3asCaCO3	1	210.1	1 mg/l	3	Acree	1/15
PO4	1	365.1	.1 mg/l	3	Acree	1/25
Ba	1	200.7	.01 mg/l	1	Hidalgo	1/26
Cd	1	200.7	.005 mg/l	1	Hidalgo	1/26
Ca	1	200.7	.01 mg/l	1	Hidalgo	1/26
Cr	1	200.7	.01 mg/l	1	Hidalgo	1/26
Cu	1	200.7	.01 mg/l	1	Hidalgo	1/26
Fe	1	200.7	.01 mg/l	1	Hidalgo	1/26
Pb	1	200.7	.001 mg/l	1	Hidalgo	1/26

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8-Feb-90

Bill Almas
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One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Attn:
Project: Fredonia,AZ

Received: 9-Jan-90
Purchase order :

Job: 901794E

Status: Final

QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservatives	Analyst	Dates(s) of Analysis
Mg	1	200.7	.01 mg/l	1	Hidalgo	1/26
Mn	1	200.7	.01 mg/l	1	Hidalgo	1/26
K	1	200.7	.5 mg/l	1	Hidalgo	1/26
SiO2	1	200.7	.01 mg/l	1	Hidalgo	1/26
Ag	1	200.7	.01 mg/l	1	Hidalgo	1/26
Se	1	270.2	.001 mg/l	1	Gilleland	1/30
As	1	206.2	.001 mg/l	1	Gilleland	1/31
Hg	1	245.1	.0002 mg/l	1	Swanson	2/5
SO4	1	375.3	5 mg/l	3	Acree	1/12
TDS	1	160.1	10 mg/l	3	Acree	1/12
Na	1	200.7	.01 mg/l	1	Hidalgo	1/26
Zn	1	200.7	.005 mg/l	1	Hidalgo	1/26
Gr. Alpha	4	900.0	1.0 pCi/l	3	Jackson	1/12-1/22
Gr. Beta	4	900.0	2.0 pCi/l	3	Jackson	1/12-1/22
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	1/18-1/22
Th-230	11	---	0.2 pCi/l	3	Ortiz	1/15-1/18
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Tonning	1/16-1/22

wrong

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
LC-056	NH4	<.1	<.1	0
"	F	.76	.76	0
"	Cl	21	21	0
"	PO4	<.1	<.1	0
"	Ba	.03	.03	0
"	Cd	<.005	<.005	0
"	Ca	176	178	0.9
"	Cr	<.01	<.01	0
"	Cu	<.01	<.01	0
"	Fe	8.65	8.70	0.6
"	Pb	<.02	<.02	0

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8-Feb-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Attn:
Project: Frednia,AZ

Received: 9-Jan-90
Purchase order :

Job: 901794E

Status: Final

DUPLICATES (Cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
LC-056	Mg	120	120	0
"	Mn	.47	.47	0
"	K	29.7	29.6	0.3
"	SiO2	8.7	8.7	0
"	Ag	<.01	<.01	0
"	Se	.010	.008	22
"	As	.011	.011	0
"	Hg	.0002	.0002	0
"	SO4	1021	989	3
"	TDS	1598	1592	.4
"	Na	78.7	77.4	0.8
"	Zn	.016	.016	0

Why do we care what the Fredonia's office's water? Which aquifer is it drawing from?

QUALITY CONTROL STANDARDS

What known?

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
NH4	2.16	1.98	1.78 - 2.18	9	94
F	.51	.50	.45 - .55	2	---
Cl	25.96	26.05	24.1 - 27.7	.3	100
PO4	.49	.50	.46 - .54	2	---
Ba	.98	1.00	.90 - 1.10	2.0	98
Cd	.215	.200	.180 - .220	7.5	108
Ca	2.06	2.00	1.80 - 2.20	3.0	---
Cr	.203	.200	.180 - .220	1.5	103
Cu	.200	.200	.180 - .220	0	102
Fe	.210	.200	.180 - .220	5.0	---
Pb	.205	.200	.180 - .220	2.5	110
Mg	2.05	2.00	1.80 - 2.20	2.5	---
Mn	.207	.200	.180 - .220	3.5	112
K	10.2	10.0	9.0 - 11.0	2.0	83

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

8-Feb-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Attn:
Project: Fredonia,AZ

Received: 9-Jan-90
Purchase order :

Job: 901794E

Status: Final

QUALITY CONTROL STANDARDS (Cont'd)

What known?

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
SiO2	1.01	1.07	.96 - 1.18	5.9	---
Ag	.94	1.00	.90 - 1.10	6.0	101
Se	.021	.025	.017 - .028	17	---
As	.100	.100	.080 - .118	0	---
Hg	.005	.005	.004 - .006	0	100
SO4	1060	1000	900 - 1100	6	---
TDS	1484	1479	1331 - 1627	.3	---
Na	.84	.86	.76 - .96	2.0	---
Zn	.211	.200	.180 - .220	5.5	109
Gr. Alpha	173 ± 4	198	178 - 218	13	---
Gr. Beta	180 ± 2	173	156 - 190	4.0	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	104 ± 3	99	94 - 104	5.1	---
U	33	34	32 - 36	2.9	---

Approved by: _____

cc: Larry Casebolt, ENERGY FUELS NUCLEAR

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

9-Feb-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Page: 1
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Attn:
Project:

Received: 5-Jan-90
Purchase order :

Job: 901779E

Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	NH4 as N mg/l	As Diss. mg/l	Ba Diss. mg/l	CO3 as CaCO3 mg/l	Cd Diss. mg/l	Ca Diss. mg/l
WS-057 Willow Springs	84	<0.1	0.005	<0.01	<0.5	<0.005	482
CN-058 Canyon Mine	212	<0.1	0.001	0.07	<0.5	<0.005	44.3

Sample	Cl mg/l	Cr Diss. mg/l	Conductance µmho/cm	Cu Diss. mg/l	F mg/l	Fe Diss. mg/l	Pb Diss. mg/l	Mg Diss. mg/l
WS-057	47	<0.01	3213	<0.01	0.9	0.13	<0.02	205
CN-058	8	<0.01	464	<0.01	0.3	0.12	<0.02	30.3

Sample	Mn Diss. mg/l	Hg Diss. mg/l	pH unit	PO4 as P mg/l	K Diss. mg/l	Se Diss. mg/l	SiO2 Diss. mg/l	Ag Diss. mg/l
WS-057	<0.01	<0.0002	7.52	<0.1	11.8	0.048	12.5	<0.01
CN-058	0.04	<0.0002	7.53	<0.1	2.4	0.002	9.9	<0.01

Sample	Na Diss. mg/l	TDS mg/l	SO4 mg/l	Zn Diss. mg/l	Gross Alpha Dissolved pCi/l	Error 2σ*
WS-057	54.2	3150	2150	5.97	32	±17
CN-058	.014	224	18	0.046	19	±4

Sample	Gross Beta Dissolved pCi/l	Error 2σ*	Ra-226 Dissolved pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*
WS-057	36	±10	0.1	±0.2	0.2	±0.4
CN-058	5.9	±1.7	1.3	±0.4	0.0	±0.3

BARRINGER LABORATORIES INC.

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1455 DEMING WAY, SUITE 15
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PHONE: (702) 358-1158

9-Feb-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 5-Jan-90
Purchase order :

Job: 901779E

Status: Final

Sample Type: Water

Sample	U Dissolved mg/l	U Total mg/l
WS-057	0.019	0.019
CN-058	0.016	0.017

BARRINGER LABORATORIES INC.

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9-Feb-90

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Page: 3
Copy: 1 of 3
Set : 1

Attn:
Project:

Received: 5-Jan-90
Purchase order :

Job: 901779E

Status: Final

Abbreviations:

Analyses:

HCO3	:	Bicarbonate
NH4 as N	:	Ammonia
As	:	Arsenic
Ba	:	Barium
CO3	:	Carbonate
Cd	:	Cadmium
Ca	:	Calcium
Cl	:	Chloride
Cr	:	Chromium
Cu	:	Copper
F	:	Fluoride
Fe	:	Iron
Pb	:	Lead
Mg	:	Magnesium
Mn	:	Manganese
Hg	:	Mercury
PO4 as P	:	Phosphate
K	:	Potassium
Se	:	Selenium
SiO2	:	Silica
Ag	:	Silver
Na	:	Sodium
TDS	:	Total Dissolved Solids
SO4	:	Sulfate
Zn	:	Zinc
Ra-226	:	Radium-226
Th-230	:	Thorium-230
U	:	Uranium

BARRINGER LABORATORIES INC.

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9-Feb-90

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Page: 4
Copy: 1 of 3
Set : 1

Attn:
Project:

Received: 5-Jan-90
Purchase order :

Job: 901779E

Status: Final

Abbreviations:

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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9-Feb-90

Bill Almas
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1200-17th St.
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Denver, CO 80202

Attn:
Project:

Received: 5-Jan-90
Purchase order :

Job: 901779E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 1/5/90 By: T. Moncrief Via: UPS

Sample Container Type: large cube
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None 4. NAOH/Zn Ac
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Cl	1	325.2	1 mg/l	3	Hobbs	1/10
NH4	1	350.1	.1 mg/l	2	Hobbs	1/11
Conductance	1	1201	.001 mg/l	3	Ryman	1/11
F	1	340.2	.05 mg/l	3	Ryman	1/11
pH	1	150.1	.01 mg/l	3	Ryman	1/11
TDS	1	160.1	10 mg/l	3	Acree	1/12
HCO3asCaCO3	1	210.1	1 mg/l	3	Acree	1/15
PO4	1	365.1	.1 mg/l	3	Hobbs	1/25
Ba	1	200.7	.01 mg/l	1	Hidalgo	1/26
Cd	1	200.7	.005 mg/l	1	Hidalgo	1/26
Ca	1	200.7	.01 mg/l	1	Hidalgo	1/26
Cr	1	200.7	.01 mg/l	1	Hidalgo	1/26
Cu	1	200.7	.01 mg/l	1	Hidalgo	1/26
Fe	1	200.7	.01 mg/l	1	Hidalgo	1/26
Pb	1	200.7	.001 mg/l	1	Hidalgo	1/26
Mg	1	200.7	.01 mg/l	1	Hidalgo	1/26
Mn	1	200.7	.01 mg/l	1	Hidalgo	1/26
K	1	200.7	.5 mg/l	1	Hidalgo	1/26
SiO2	1	200.7	.01 mg/l	1	Hidalgo	1/26
Ag	1	200.7	.01 mg/l	1	Hidalgo	1/26
As	1	206.2	.001 mg/l	1	Gilleland	1/31
Se	1	270.2	.001 mg/l	1	Gilleland	1/30
Hg	1	245.1	.0002 mg/l	1	Swanson	2/1

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QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservatives	Analyst	Date(s) of Analysis
SO4	1	375.3	5 mg/l	3	Acree	1/12
Na	1	200.7	.01 mg/l	1	Hidalgo	1/26
Zn	1	200.7	.005 mg/l	1	Hidalgo	1/26
TDS	1	160.1	10 mg/l	3	Acree	1/12
Gr. Alpha	4	900.0	1.0 pCi/l	3	Kidwell	1/11-1/22
Gr. Beta	4	900.0	2.0 pCi/l	3	Kidwell	1/11-1/22
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	1/16-1/18
Th-230	11	---	0.2 pCi/l	3	Ortiz	1/10-1/12
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Krizman	1/10-1/12

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
CN-058	Cl	7.9	7.9	0
"	NH4	<.1	<.1	0
"	F	.30	.29	3
"	TDS	224	216	4
WS-057	HCO3	83.6	81.6	2
CN-058	PO4	<.1	<.1	0
"	Ba	.07	.07	0
"	Cd	<.005	<.005	0
"	Ca	44.3	42.7	3.6
"	Cr	<.01	<.01	0
"	Cu	<.01	<.01	0
"	Fe	.12	.11	9
"	Pb	<.02	<.02	0
"	Mg	30.2	29.9	1.0
"	Mn	.04	.03	---
"	K	2.4	2.1	---
"	SiO2	9.9	9.7	2.0
"	Ag	<.01	<.01	0

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DUPLICATES (Cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
CN-058	As	.001	.001	0
"	Se	.0482	.051	6
"	Hg	<.0002	<.0002	0
"	SO4	18	17	6
"	Na	5.97	5.98	0.2
"	Zn	.046	.004	4.3
"	TDS	224	216	4
WS-057	Ra-226	0.1 ± 0.2	0.1 ± 0.1	0
CN-058	Ra-226	1.0 ± 0.3	1.6 ± 0.4	23

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Cl	24.8	26.05	24.1 - 27.7	5	88
NH4	2.08	1.98	1.78 - 2.18	5	---
F	.51	.50	.45 - .55	2	---
TDS	1484	1479	1331 - 1627	.3	---
PO4	.49	.50	.46 - .54	2	---
Ba	.99	1.00	.90 - 1.10	1.0	99
Cd	.215	.200	.180 - .220	7.5	105
Ca	.214	.200	.180 - .220	7.0	---
Cr	.210	.200	.180 - .220	5.0	103
Cu	.202	.200	.180 - .220	1.0	100
Fe	.210	.200	.180 - .220	5.0	112
Pb	.206	.200	.180 - .220	3.0	102
Mg	.210	.200	.180 - .220	5.0	---
Mn	.212	.200	.180 - .220	6.0	103
K	10.2	10.0	9.0 - 11.0	2.0	104
SiO2	1.00	1.07	.96 - 1.18	6.9	114

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QUALITY CONTROL STANDARDS (Cont'd)

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Ag	.95	1.00	.90 - 1.10	5.0	100
As	.100	.100	.080 - .118	0	---
Se	.021	.025	.017 - .028	17	---
Hg	.005	.005	.004 - .006	0	80
SO4	1060	1000	900 - 1100	6	---
Na	.85	.86	.76 - .96	1.0	92
Zn	.214	.200	.180 - .220	7.0	106
TDS	1484	1479	1331 - 1627	.3	---
Gr. Alpha	115 ± 3	110	99 - 121	4.6	---
Gr. Beta	172 ± 2	173	156 - 190	0.6	---
Ra-226	101 ± 3	101	96 - 106	0.0	---
Th-230	100 ± 3	99	94 - 104	1.0	---
U	33	34	32 - 36	2.9	---

Approved by: _____

cc: Larry Casebolt, ENERGY FUELS NUCLEAR



HERMIT MINE
GROUNDWATER MONITORING REPORT

MINING AND POST MINING PHASE

First Quarter, 1990
Second Quarter, 1990

Hermit Mine
Groundwater Monitoring Report
Fourth Quarter, 1989
First & Second Quarter, 1990

Introduction

The Hermit Mine operates under the terms and conditions of the Hermit Mine Groundwater Protection Permit #G-0035-08. Section II B.1.b of the Permit outlines groundwater monitoring actions which must be taken during mining operations. This report presents and summarizes groundwater monitoring data during the first and second quarter of 1990.

Events During Report Period

On January 31, 1990, the last ore was hoisted from the Hermit Mine. A mine abandonment plan, describing proposed procedures for closure, was submitted to Arizona Department of Environmental Quality (ADEQ) on February 19, 1990. Pumping to surface containment ponds ceased on February 7, 1990. At the time of this writing, closure procedures are in progress.

Sample Descriptions

Table I shows a summary of all Phase II and III groundwater monitoring samples associated with the Hermit Mine to date. Four monitoring samples are being presented as part of this Report. Samples HER 061 and HER 064 are First Quarter, 1990 and Second Quarter, 1990 samples respectively, taken from the supply/monitoring well, Registry #55-518877. Sample HER 059 represents the First Quarter, 1990 mine sump sample (final sump sample). HERO 62 is a split sample of HER 061. HERO 62 was taken as a comparison and quality control check. HERO 62 was collected at the same time and following the same procedures as HER 061, but was sent to a different laboratory for analysis.

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Water Quality Results

Table II, Mining Water Quality Results, presents a comparison of monitor well water quality analysis results to Maximum Groundwater Limits as determined following procedures in the Groundwater Protection Permit. Table II summarizes parameters which indicated exceedances of Maximum Groundwater Limits, as defined in the Groundwater Protection Permit.

TABLE I

Summary of Phase II (Mining) Groundwater Sampling

Sample Date	Sample Number	Sample Purposes	Sampling Parameters	Monitor Period
06-27-89	HER 043	Mine Sump	II.B.2.b	2nd Quarter
06-29-89	HER 044	Monitor Well	II.B.2.a	2nd Quarter
06-27-89	HER 045	Shaft Sample	II.A.2.b	2nd Quarter
09-21-89	HER 048	Monitor Well	II.A.2.b	3rd Quarter
09-21-89	HER 049	Sump Sample	II.A.2.b	3rd Quarter
09-21-89	HER 050	Shaft Sample	II.A.2.b	3rd Quarter
10-19-89	HER 051	Confirmation Sample	II.A.2.b	2nd Quarter
10-02-89	HER 1S-45	Septic Sample	II.A.2.b	Annual
12-07-89	HER 052	Monitor Well	II.A.2.b	4th Quarter
02-13-90	HER 059	Sump Sample	II.A.2.b	1st Quarter

Summary of Phase III (Post Mining) Groundwater Sampling

03-28-90	HER 061	Monitor Well	II.A.2.b	1st Quarter
03-28-90	HERO 062	Monitor Well	II.A.2.b	Split Sample (HER 061)
04-27-90	HER 064	Monitor Well	II.A.2.b	2nd Quarter

TABLE II



Summary of Exceedances of Maximum Groundwater Limits, Mining and Post Mining Phase

Parameters	Amount of Exceedance (mg/1)					
	HER 044	HER 048	HER 051	HER 052	HER 061	HER 064
Fe	0.79	0.39			2.290	1.989
Mn	0.043	0.30	0.20	0.063	0.033	
Zn				0.069		
U (Tot.)	.0005	0.003	0.0034	0.021	0.0006	0.005
Alk	-(1)					9.25
Cl	-			7.92		
Mg	-		2.0			
K	-		2.93	15.50		
Na	-		16.28	52.27		
Gross Beta, pCi/1	-		10.52	24.51		
Ra226,pCi/1	-				28.63	
pH, Units	-	0.07		0.44	0.127	1.31

(1) Analysis not performed for these parameters.
Analysis performed for the parameters listed in Section II,B.2.a.

TABLE II

SUMMARY OF MINING/PREMINING GROUNDWATER QUALITY

HERMIT MINE MINING/PREMINING PHASE GRW QUALITY 3-JUL-90 11:20:14 Pg 1

PARAMETERS, UNITS	PREMINING SAMPLE MEAN	SAMPLE RESULTS STANDARD DEVIATION	SAMPLE RESULTS HER 044 06-29-89	SAMPLE RESULTS HER 048 09-21-89	SAMPLE RESULTS HER 051 10-19-89	SAMPLE RESULTS HER 052 12-07-89	SAMPLE RESULTS HER 061 03-28-90	SAMPLE RESULTS HER 64 04-27-90	MAXIMUM ACCEPTABLE VALUE
As,mg/l	0.012	0.0060	0.004	0.008	0.022	0.0080	0.003	<0.001	0.0241
Ba,mg/l	0.022	0.0179	0.02	0.02	0.01	0.0200	0.03	0.0100	0.0578
Cd,mg/l	0.005	0.0112	0.006	<0.005	<0.005	<0.005	0.009	0.0070	0.0274
Cu,mg/l	0.022	0.0110	0.02	<0.01	<0.01	0.0200	0.04	<0.01	0.0439
Fe,mg/l	6.98	2.1157	12	11.6	4.71	1.1300	13.5	13.2000	11.2114
Pb,mg/l	0.03	0.0671	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	0.1642
Mn,mg/l	0.108	0.0404	0.23	0.49	0.39	0.2500	0.22	0.1800	0.1867
Hg,mg/l	0.00054	0.0005	<0.0001	<0.0001	<0.0002	0.0002	0.0003	<0.0002	0.0016
Se,mg/l	0.0152	0.0138	0.02	0.009	0.023	0.0060	<0.001	<0.001	0.0428
Ag,mg/l	0.01	0.0100	<0.01	<0.01	<0.01		0.01	<0.01	0.0300
Zn,mg/l	0.0678	0.0603	0.077	<0.005	0.013	0.2580	0.028	<0.005	0.1885
U, Total mg/l	0.0025	0.0003	0.0035	0.0043	0.0064	0.024	0.0036	0.0080	0.0030
Alk as CaCO3,mg/l	157.4	1.6733		150		155.0000	149	170.0000	160.7466
HCO3 as CaCO3,mg/l	157.4	1.6733		150	150	155	149	170.0000	160.7466
CO3,mg/l	0	0.0000			<1			<1	0.0000
Ca,mg//l	547	36.5718		542	547	466.0000	609	610.0000	620.1437
Cl,mg/l	41.2	1.4370		40	39	52.0000	38	41.0000	44.0740
Cr,mg/l	0.08	0.0663		<0.01	0.01	<0.01	<0.01	<0.01	0.2127
F,mg/l	1.37	0.0815		1.28	1.43	1.3000	1.4	1.4000	1.5331
Mg,mg/l	181.6	8.9331		186	201	155.0000	186	186.0000	199.4662
PO4,mg/l	0	0.0000		<0.1	<0.1	<0.1	0.2	0.3000	0.0000
K,mg/l	23.28	2.6957		24.2	31.6	44.5000	24.2	22.5000	28.6715
SiO2,mg/l	12.42	0.9602		11.5	9.8	8.9000	13.6	13.3000	14.3404
Na,mg/l	74.8	5.4649		76	102	138.0000	72.6	82.6000	85.7298
SO4,mg/l	2226	99.3982		2280	2280	2280.0000	2290	1150.0000	2424.7964
TDS,mg/l	3456	29.6648		3440	3220	3310.0000	3430	3320.0000	3515.3296
NO3 as N,mg/l	0.14	0.3130		<0.1	<0.1	<0.1	<0.1	<0.1	0.7661
Gross alpha,pCi/l	20.4	31.7616	28	19	78	22.0000	21	44.0000	83.9232
Gross beta,pCi/l	33	5.2440	40	41	54	68.0000	40	35.0000	43.4881
Th230,pCi/l	0.34	0.3286		0.2	0	3.1000	0	0.9000	0.9973
Ra226,pCi/l	1.96	1.2054		3.3	0.8	2.4000	36	1.7000	4.3708
Electrical conductivity,	3324	115.4556		3470	3600	3470.0000	3330	3318.0000	3554.9112
umhos/cm	0	0.0000							
pH,units	7.5525	0.3500		6.92		7.2900	6.98	8.1600	6.8525
TSS,mg/l	32.25	37.3486					59	93.0000	0.0000
U,Dissolved mg/l				0.0015		0.003	0.0005	0.0010	

Review of sample exceedances show no discernable trend. Total uranium concentration continues to exceed Maximum Groundwater Limits as does pH.

Discussion

As discussed in the "Hermit Groundwater Monitoring Report, Mining Phase", dated February 12, 1990, although total uranium continues to exceed Maximum Groundwater Limits, dissolved uranium is consistently below Groundwater Limits. This trend has persisted in four separate analysis. It is quite possible, therefore, that increased total uranium values can be attributed solely to increased suspended solids resulting from well field development.

Of the other parameters analyzed for during Phase II or III, one or more samples exceeded primary or secondary drinking water standards for gross alpha ^{226}Ra, manganese and gross beta. The Second Quarter, 1990 monitor well sampling was split, sampled and identical samples sent to different laboratories for analysis. Both laboratories are reputable, experienced laboratories for inorganic and radiochemical analysis. Both laboratories have strict internal QA/QC programs. Nevertheless, analytical results varied significantly for many parameters.

For example, Barringer Laboratories indicated a total ^{226}Ra concentration of 33±2 pCi/liter for HER 061. The split sample from Accu Labs indicated a total ^{226}Ra concentration of 8.0 ± 0.4. Similar differences exist throughout. This comparison serves to illustrate the analytical variability which exist at low concentrations.



FIRST QUARTER, 1990

GROUNDWATER MONITOR WELL

ANALYTICAL RESULTS

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17-May-90

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Sample	Alkalinity as CaCO3 mg/l	As Dissolved mg/l	Ba Dissolved mg/l	HCO3 as CaCO3 mg/l	Cd Dissolved mg/l	Ca Dissolved mg/l
HER061	149	0.003	0.03	149	0.009	609
PN060	34	0.001	0.05	34	<0.005	303

Sample	Cl mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Dissolved mg/l	F mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l
HER061	38	<0.01	3330	0.04	1.4	13.5	0.02
PN060	12	<0.01	2230	0.03	0.6	16.2	<0.02

Sample	Mg Dissolved mg/l	Mn Dissolved mg/l	Hg Dissolved mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l
HER061	186	0.22	0.0003	<0.1	6.98	0.2
PN060	159	2.58	0.0005	<0.1	6.46	0.2

Sample	K Dissolved mg/l	Se Dissolved mg/l	SiO2 Dissolved mg/l	Ag Dissolved mg/l	Na Dissolved mg/l	TDS mg/l
HER061	24.2	<0.001	13.6	0.01	72.6	3430
PN060	16.5	<0.001	3.5	<0.01	34.4	2130

Sample	TSS mg/l	SO4 mg/l	Zn Dissolved mg/l	Gross Alpha Error Dissolved pCi/l	2σ*	Gross Beta Error Dissolved pCi/l	2σ*
HER061	59	2290	0.028	23	±18	21	±10
PN060	39	1480	0.057	47	±13	29	±8

Sample	Gross Alpha Error Total pCi/l	2σ*	Gross Beta Error Total pCi/l	2σ*	Ra-226 Error Dissolved pCi/l	2σ*
HER061	21	±19	40	±11	33	±2
PN060	32	±7	11	±5	1.1	±0.4

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Sample	Ra-226 Total pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Dissolved mg/l	U Total mg/l
HER061	36	±2	0.0	±0.3	0.0	±0.4	0.0005	0.0036
PN060	1.7	±0.4	0.0	±0.3	0.3	±0.5	<0.0003	0.0020

Sample	CO3 as CaCO3 mg/l
HER061	<1
PN060	<1

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Abbreviations:

Parameters:

As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium
CO3	: Carbonate

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Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

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QUALITY CONTROL DATA SHEET

Time Received: 8:30 Date: 4/2/90 By: Receiving Via: UPS

Sample Container Type: large cube, liter cube
Sample Type: water
Preservative When Receivied: 1. HNO3 2. H2SO4 3. None 4. NaOH/ZnAc
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Cl	1	325.2	1 mg/l	3	Hobbs	4/5
NO3	1	353.1	.1 mg/l	2	Hobbs	4/4
pH	1	150.1	.01 mg/l	3	Hatcher	4/4
Alk	1	210.1	1 mg/l	3	Hatcher	4/6
F	1	340.2	.05 mg/l	3	Ryman	4/6
PO4	1	365.1	.1 mg/l	3	Hobbs	4/6
Cond.	1	1201	.001 mg/l	3	Ryman	4/23
As	1	206.2	.001 mg/l	1	Gilleland	4/23
Hg	1	245.1	.0002 mg/l	1	Swanson	4/23
Se	1	270.2	.001 mg/l	1	Gilleland	4/24
Cl	1	200.7	1 mg/l	3	Hidalgo	4/30
Ba	1	200.7	.01 mg/l	1	Hidalgo	4/30
Cd	1	200.7	.005 mg/l	1	Hidalgo	4/30
Ca	1	200.7	.01 mg/l	1	Hidalgo	4/30
Cu	1	200.7	.01 mg/l	1	Hidalgo	4/30
Fe	1	200.7	.01 mg/l	1	Hidalgo	4/30
Pb	1	200.7	.02 mg/l	1	Hidalgo	4/30
Mg	1	200.7	.01 mg/l	1	Hidalgo	4/30
Mn	1	200.7	.01 mg/l	1	Hidalgo	4/30
K	1	200.7	.5 mg/l	1	Hidalgo	4/30
Ag	1	200.7	.01 mg/l	1	Hidalgo	4/30
Na	1	200.7	.01 mg/l	1	Hidalgo	4/30

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QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Zn	1	200.7	.005 mg/l	1	Hidalgo	4/30
TDS	1	160.1	10 mg/l	3	Hatcher	4/5
TSS	1	160.2	4 mg/l	3	Hatcher	4/4
SO4	1	375.3	4 mg/l	3	Hatcher	4/6
SiO2	1	200.7	.01 mg/l	1	Hidalgo	4/30
Gr. Alpha	4	900.0	1.0 pCi/l	3	Kidwell	4/4-4/16
Gr. Beta	4	900.0	2.0 pCi/l	3	Kidwell	4/4-4/16
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	5/7-5/9
Th-230	11	---	0.2 pCi/l	3	Ortiz	4/3-4/5
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Tonning	4/26-5/3

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

17-May-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 2-Apr-90 16:37

Job: 902181E

Status: Final

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
PN-060-Pinenut Mine Waterwell	Cl	12.15	12.15	0
" "	NO3	<.1	<.1	0
" "	pH	6.46	6.41	.8
" "	Alk	33.5	32.5	3.0
" "	F	.58	.59	1.7
" "	PO4	.18	.18	0
HER-061-Hermit Mine Waterwell	As	.003	.003	0
PN-060-Pinenut Mine Waterwell	Hg	.0005	.0005	0
HER-061-Hermit Mine Waterwell	Se	<.001	<.001	0
PN-060-Pinenut Mine Waterwell	Cr	<.01	<.01	0
" "	Ba	.05	.05	0
" "	Cd	<.005	<.005	0
" "	Ca	303	303	0
" "	Cu	.03	.03	0
" "	Fe	16.2	16.2	0
" "	Pb	<.02	<.02	0
" "	Mg	159	164	3.0
" "	Mn	2.58	2.59	0.4
" "	K	16.5	17.2	4.1
" "	Ag	<.01	<.01	0
" "	Na	34.4	36.9	4.1
" "	Zn	.057	.070	18.6
" "	TDS	2126	2118	.4
" "	TSS	59	39	2.6
" "	SO4	1483	1498	1.0
" "	SiO2	3.5	3.4	2.9
" "	Gr. Alpha	39 ± 13	54 ± 13	16
" "	Gr. Beta	24 ± 8	34 ± 7	17
" "	U	0.0020	0.0019	2.6

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

17-May-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 2-Apr-90 16:37

Job: 902181E

Status: Final

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Cl	25.26	26.05	24.1 - 27.7	3.1	---
NO3	2.08	1.98	1.78 - 2.18	4.9	71
F	.51	.50	.45 - .55	2.0	---
PO4	.53	.50	.46 - .54	5.8	---
Cond.	1413	1413	----	0	---
As	.102	.100	.080 - .118	2	---
Hg	.005	.005	.004 - .006	0	---
Se	.021	.025	.017 - .028	17	---
Cl	.208	.200	.180 - .220	4.0	101
Ba	1.08	1.00	.90 - 1.10	8.0	99
Cd	.212	.200	.180 - .220	6.0	107
Ca	2.07	2.00	1.80 - 2.20	3.5	---
Cu	.196	.200	.180 - .220	2.0	93
Fe	.203	.200	.180 - .220	1.5	---
Pb	.209	.200	.180 - .220	4.5	93
Mg	1.98	2.00	1.80 - 2.20	1.0	---
Mn	.207	.200	.180 - .220	3.5	125
K	10.2	10.0	9.0 - 11.0	2.0	78
Ag	1.02	1.00	.90 - 1.10	2.0	91
Na	.78	.86	.76 - .96	8	---
Zn	.204	.200	.180 - .220	2.0	105
TDS	1434	1479	1331 - 1627	3.1	---
SO4	1063	1000	900 - 1100	6.1	---
SiO2	1.06	1.07	.96 - 1.18	1.0	81
Gr. Alpha	190 ± 5	196	176 - 216	3.1	---
Gr. Beta	171 ± 2	173	156 - 190	1.2	---
Ra-226	106 ± 3	101	91 - 111	5.0	---
Th-230	89 ± 2	96	86 - 106	7.3	---
U	35	34	31 - 37	2.9	---

Approved by: _____

SEND TO: BARRINGER LABORATORIES INC.
15000 W. 6TH AVE. SUITE 300
GOLDEN, COLO. 80401

SENT FROM:

CHAIN OF CUSTODY RECORD - CLIENT COPY

Sampler's Name: L. CASEBOLT
Company Name: ENERGY FUELS NUCLEAR INC.
Company Address: _____

I.D. #	Client I.D. #	Sample Location	Date/Time of Sampling	Raw, Unfiltered, Plastic	Raw, Filtered, Plastic	Raw, Filtered, Glass	HNO_3, Filtered, Plastic	H_2SO_4, Filtered, ~~Glass~~ Plastic	NaOH + ZN Acetate, Filtered, Plastic			Total Number of Bottles	(Instructions for Analysis on back of form) Comments
	HER061	HERMIT MINE WATER WELL		1			1	1	1			4	
	PNO60	PINENUT MINE WATER WELL		1			1	1	1			4	

Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Date/Time
L. Casebolt	3/28/90 5:30 P.M.	Barbara Hines	4/2/90 8:30
Relinguished By: (Signature)	Date/Time	Received for BLI By: (Signature)	Date/Time

Shipping Information
Carrier: UPS
Date Shipped: 3-29-90

SAMPLE ANALYSIS INFORMATION

Perform those analysis marked with an X and circled

X	Ag Total **Dissolved** Suspended	X	pH
X	As Total **Dissolved** Suspended	X	Specific Cond. (micromhos per centimeter
X	Ba Total **Dissolved** Suspended	X	TDS
	B Total Dissolved Suspended	X	TSS
X	Ca Total **Dissolved** Suspended	X	NO_3 as N
X	Cd Total **Dissolved** Suspended		NH_4 as N
X	Cr **Total** Dissolved Suspended	X	PO_4
X	Cu Total **Dissolved** Suspended	X	SO_4
X	F Total **Dissolved** Suspended		SO_3
X	Fe Total **Dissolved** Suspended	X	SiO_2
X	Pb Total **Dissolved** Suspended		
X	Mg Total **Dissolved** Suspended		
	Mo Total Dissolved Suspended	X	Gross Alpha[a] **Total** **Dissolved** Suspended
X	Mn Total **Dissolved** Suspended	X	Gross Beta[a] **Total** **Dissolved** Suspended
X	Hg Total **Dissolved** Suspended		^{228}Ra[a] Total Dissolved Suspended
X	K Total **Dissolved** Suspended	X	^{226}Ra[a] **Total** **Dissolved** Suspended
X	Se Total **Dissolved** Suspended	X	Total U_{nat} **Total** **Dissolved** Suspended
X	Na Total **Dissolved** Suspended		^{210}Pb[a] Total Dissolved Suspended
X	Zn Total **Dissolved** Suspended		^{210}Po[a] Total Dissolved Suspended
X	Alkalinity (as carbonate)		^{234}U[a] Total Dissolved Suspended
X	Bicarbonate		^{235}U[a] Total Dissolved Suspended
X	Carbonate		^{238}U[a] Total Dissolved Suspended
X	Chloride		^{228}Th[a] Total Dissolved Suspended
		X	^{230}Th[a] **Total** **Dissolved** Suspended
			^{232}Th[a] Total Dissolved Suspended
Units are mg/l unless otherwise noted			^{40}K[a] Total Dissolved Suspended

[a]Units are pCi/l

SECOND QUARTER, 1990

GROUNDWATER MONITOR WELL

ANALYTICAL RESULTS

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1166

22-Jun-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 2 of 3
Set : 1

Attn:
Project:

Received: 18-May-90 15:35

PO #:

Job: 902490E

Status: Final

Sample Type: Water

Sample	Ag Dissolved mg/l	As Dissolved mg/l	Ba Dissolved mg/l	Ca Dissolved mg/l	Cd Dissolved mg/l	Cr Total mg/l
HER064	<0.01	<0.001	0.01	610	0.007	<0.01

Sample	Cu Dissolved mg/l	F mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l	Mg Dissolved mg/l	Mn Dissolved mg/l
HER064	<0.01	1.4	13.2	<0.02	186	0.18

Sample	Hg Dissolved mg/l	K Dissolved mg/l	Se Dissolved mg/l	Na Dissolved mg/l	Zn Dissolved mg/l	Alkalinity as CaCO3 mg/l
HER064	<0.0002	22.5	<0.001	82.6	<0.005	170

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l	TSS mg/l
HER064	170	<1	41	8.06	3318	3320	93

Sample	NO3 as N mg/l	PO4 as P mg/l	SO4 mg/l	SiO2 Dissolved mg/l	Gross Alpha Error Dissolved pCi/l	2σ*
HER064	<0.1	0.3	1150	13.3	12	±14

Sample	Gross Beta Error Dissolved pCi/l	2σ*	Gross Alpha Error Total pCi/l	2σ*	Gross Beta Error Total pCi/l	2σ*
HER064	37	±12	44	±18	35	±12

BARRINGER LABORATORIES INC.

18000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE. (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE. (702) 356-1168

22-Jun-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 2
Copy: 2 of 3
Set : 1

Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

Sample Type: Water

Sample	Ra-226 Dissolved pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*
HER064	1.7	±0.5	2.0	±0.7	0.9	±0.6	1.0	±0.9

Sample	U Dissolved mg/l	U Total mg/l
HER064	0.0008	0.0082

BARRINGER LABORATORIES INC.

16000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1466 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1150

22-Jun-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 3
Copy: 2 of 3
Set : 1

Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

Abbreviations:

Parameters:

Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4 as P	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ra-226	: Radium-226
Th-230	: Thorium-230

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE. (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

22-Jun-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 4
Copy: 2 of 3
Set : 1

Attn:
Project: PO #:

Received: 18-May-90 15:35

Job: 902490E Status: Final

U : Uranium

Units:

mg/l : milligrams per liter
µmho/cm : micromhos per centimeter at 25C
pci/l : picoCuries per liter
2σ* : * Counting error at the 95% confidence level, 2σ

Quality control:

< : less than

Signed:

.....

Gary Zito
Laboratory Supervisor



FIRST QUARTER, 1990

SPLIT SAMPLE

ANALYTICAL RESULTS

ACCU-LABS RESEARCH, INC.

11485 West 48th Avenue - Wheat Ridge, CO 80033 - (303) 423-2766

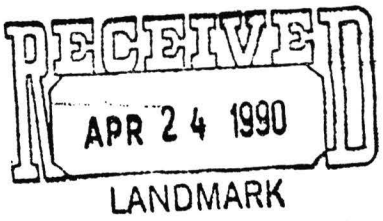
A N A L Y S I S R E P O R T

DATE: 04/20/90 PAGE 1

BILL ALNAS
ENERGY FUELS NUCLEAR
2555 N. HIGHWAY 89A
FREDONIA, AZ 86022

Lab Job Number: 9813-33670-1
Date Samples Received: 04/02/90
Customer PO Number: 27883

Copy To:
BILL ALNAS
ENERGY FUELS NUCLEAR
1 TABOR CENTER, SUITE 2500
1200 17TH. ST.
DENVER, CO 80202



These samples to be disposed of 30 days after the date of this report.

ALR Designation -	9813-33670-1-1
Sponsor Designation -	HERO 62
Date Collected -	03/28/90

Determinations in mg/L unless noted

Barium - dissolved	<0.05
Cadmium - dissolved	<0.005
Calcium - dissolved	510
Chromium - total	0.12
Copper - dissolved	0.072
Iron - dissolved	86
Magnesium - dissolved	200
Manganese - dissolved	1.1
Mercury - dissolved	<0.0001
Potassium - dissolved	22
Silica-ICP - dissolved	5.9
Silver - dissolved	<0.005
Sodium - dissolved	69
Zinc - dissolved	0.023
Alkalinity, Total (as CaCO3 to ph 4.5)	150

ACCU-LABS RESEARCH, INC.
A N A L Y S I S R E P O R T
DATE: 04/20/90 PAGE 2
Lab Job Number 9813-33670-1

These samples to be disposed of 30 days after the date of this report.

ALR Designation -	9813-33670-1-1
Sponsor Designation -	HERO 62
Date Collected -	03/28/90

Determinations in mg/L unless noted

Carbonate (as CO3)	<5
Bicarbonate (as HCO3)	180
pH (pH Units)	7.4
Specific Conductance (µmhos/cm)	3,500
Arsenic - dissolved	<0.01 [9]
Lead - dissolved	<0.005
Selenium - dissolved	<0.005
Nitrate (as N)	<0.05
Orthophosphate (as P)	0.07
Total Dissolved Solids (@180 °C)	3,400
Total Suspended Solids (@105 °C)	280
Chloride	48
Fluoride	1.6
Sulfate (as SO4)	2,000

Notes:
[9] -- HIGHER D.L. DUE TO SAMPLE MATRIX INTERFERENCE

By: Mary Fabisiak
Mary Fabisiak
Water Laboratory Supervisor

MF/dh dh

ACCU-LABS RESEARCH, INC.

11485 West 48th Avenue - Wheat Ridge, CO 80033 - (303) 423-2766

CORRECTED REPORT

ANALYSIS REPORT

DATE: 06/27/90 PAGE 1

BILL ALMAS
ENERGY FUELS NUCLEAR
2555 N. HIGHWAY 89A
FREDONIA, AZ 86022

Lab Job Number: 9813-33670-1
Date Samples Received: 04/02/90
Customer PO Number: 27883

Copy To:
BILL ALMAS
ENERGY FUELS NUCLEAR
1 TABOR CENTER, SUITE 2500
1200 17TH. ST.
DENVER, CO 80202

These samples to be disposed of 30 days after the date of this report.

ALR Designation -	9813-33670-1-1
Sponsor Designation -	HERO 62
Date Collected -	03/28/90

Determinations in pCi/L unless noted

Gross Alpha - dissolved	6 ± 20 *
Gross Alpha - total	12 ± 20 *
Gross Beta - dissolved	25 ± 16 *
Gross Beta - total	26 ± 16 *
Radium-226 - dissolved	6.1 ± 0.4 *
Radium-226 - total	8.0 ± 0.4 *
Thorium-230 - dissolved	0.3 ± 0.2 *
Thorium-230 - total	0.5 ± 0.3 *
Uranium - dissolved (mg/L)	<0.001
Uranium - total (mg/L)	0.005

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.

By: Bud Summers
Radiochemistry Supervisor

BS/dh dh

FIRST QUARTER, 1990

MINE SUMP ANALYTICAL RESULTS

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

22-Mar-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 13-Feb-90
Purchase order :

Job: 901962E

Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	As Dissolved mg/l	Ba Dissolved mg/l	CO3 as CaCO3 mg/l	Cd Dissolved mg/l
HER 059	196	0.266	<0.01	196	<0.005

Sample	Ca Dissolved mg/l	Cl mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Dissolved mg/l	F mg/l
HER 059	513	30	<0.01	3190	<0.01	1.1

Sample	Fe Dissolved mg/l	Pb Dissolved mg/l	Mg Dissolved mg/l	Mn Dissolved mg/l	Hg Dissolved mg/l
HER 059	0.11	0.04	168	0.04	<0.0002

Sample	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Dissolved mg/l	Se Dissolved mg/l	SiO2 Dissolved mg/l
HER 059	6.0	7.74	<0.1	27.5	0.008	9.9

Sample	Ag Dissolved mg/l	Na Dissolved mg/l	TDS mg/l	TSS mg/l	SO4 mg/l	Zn Dissolved mg/l
HER 059	0.01	76.6	3290	11	2180	0.094

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

22-Mar-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 13-Feb-90
Purchase order :

Job: 901962E

Status: Final

Sample Type: Water

Sample	Gross Alpha Error Dissolved pCi/l	2σ*	Gross Beta Error Dissolved pCi/l	2σ*	Gross Alpha Error Suspended pCi/l	2σ*
HER 059	5500	±100	1190	±30	750	±20

Sample	Gross Beta Error Suspended pCi/l	2σ*	Ra-226 Error Dissolved pCi/l	2σ*	Ra-226 Error Suspended pCi/l	2σ*
HER 059	1040	±10	210	±10	83	±3

Sample	Th-230 Error Dissolved pCi/l	2σ*	Th-230 Error Suspended pCi/l	2σ*	U Dissolved mg/l	U Suspended mg/l
HER 059	0.5	±0.6	100	±10	4.29	0.243

BARRINGER LABORATORIES INC.

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PHONE: (702) 358-1158

22-Mar-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 13-Feb-90
Purchase order :

Job: 901962E

Status: Final

Pending analyses:

CO3//mg/l

Abbreviations:

Analyses:

As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
SO4	: Sulfate
Zn	: Zinc

BARRINGER LABORATORIES INC.

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22-Mar-90

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ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project: Purchase order :

Received: 13-Feb-90

Job: 901962E Status: Final

Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Abbreviations:

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

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22-Mar-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Received: 13-Feb-90
Purchase order :

Job: 901962E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: Date: 2/13/90 By: Receiving Via: Picked up

Sample Container Type: large cube
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None 4. NaOH/ZnoAc
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
F	1	340.2	.05 mg/l	3	Acree	2/16
Cl	1	325.2	1 mg/l	3	Hobbs	2/16
PO4	1	365.1	.1 mg/l	3	Hobbs	2/20
NO3	1	353.1	.1 mg/l	2	Hobbs	12/21
Cr	1	200.7	.01 mg/l	1	Hidalgo	2/22
Ba	1	200.7	.01 mg/l	1	Hidalgo	2/22
Cd	1	200.7	.005 mg/l	1	Hidalgo	2/22
Ca	1	200.7	.01 mg/l	1	Hidalgo	2/22
Cu	1	200.7	.01 mg/l	1	Hidalgo	2/22
Fe	1	200.7	.01 mg/l	1	Hidalgo	2/22
Pb	1	200.7	.001 mg/l	1	Hidalgo	2/22
Mg	1	200.7	.01 mg/l	1	Hidalgo	2/22
Mn	1	200.7	.01 mg/l	1	Hidalgo	2/22
K	1	200.7	.5 mg/l	1	Hidalgo	2/22
SiO2	1	200.7	.01 mg/l	1	Hidalgo	2/22
Ag	1	200.7	.01 mg/l	1	Hidalgo	2/22
HCO3	1	210.1	1 mg/l	3	Acree	2/23
Hg	1	245.1	.0002 mg/l	1	Swanson	3/2
pH	1	150.1	.01 mg/l	3	Acree	2/23
Se	1	270.2	.001 mg/l	1	Gilleland	3/2
As	1	206.2	.001 mg/l	1	Gilleland	3/5
Conductance	1	1201	.001 mg/l	1	Hencmann	2/19

BARRINGER LABORATORIES INC.

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22-Mar-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

Purchase order :

Received: 13-Feb-90

Job: 901962E

Status: Final

QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservatives	Analyst	Date(s) of Analysis
TDS	1	160.1	10 mg/l	3	Acree	2/19
SO4	1	375.3	5 mg/l	3	Acree	2/19
Na	1	200.7	.01 mg/l	1	Hidalgo	2/22
Zn	1	200.7	.005 mg/l	1	Hidalgo	2/22
TSS	1	160.2	4 mg/l	3	Acree	2/23
Gr. Alpha	4	900.0	1.0 pCi/l	3	Kidwell	2/26-3/12
Gr. Beta	4	900.0	2.0 pCi/l	3	Kidwell	2/26-3/12
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	2/20-2/26
Th-230	11	---	0.2 pCi/l	3	Jackson	2/15-2/19
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Krizman	2/13-2/16

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER-059	F	1.12	1.15	3
"	Cl	30.3	30.3	0
"	PO4	<.1	<.1	0
"	NO3	6.2	6.2	0
"	Cr	<.01	<.01	0
"	Ba	<.01	<.01	---
"	Cd	<.005	<.005	0
"	Ca	513	537	4.5
"	Cu	<.01	<.01	0
"	Fe	.11	.11	0
"	Pb	.04	.02	---
"	Mg	168	175	4.6
"	Mn	.04	.04	0
"	K	27.5	28.7	4.1
"	Sio2	9.9	10.3	4.0
"	Ag	.01	<.01	---

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DUPLICATES (Cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER-059	HCO3	195.8	195.8	0
"	Hg	<.0002	<.0002	0
"	pH	7.74	7.78	.5
"	Se	.008	.008	0
"	As	.266	.272	2
"	Conductance	3192	3196	.1
"	TDS	3289	3282	.2
"	SO4	2184	2144	.2
"	Na	76.6	80.2	0.7
"	Zn	.094	.101	7.0
"	TSS	11	12	8.7

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
F	.50	.50	.45 - .55	0	---
Cl	26.5	26.05	24.1 - 27.7	2	---
PO4	.55	.50	.46 - .54	9.5	---
NO3	2.14	1.98	1.78 - 2.18	8	76
Cr	.197	.200	.180 - .220	1.5	79
Ba	.97	1.00	.90 - 1.10	3.0	94
Cd	.213	.200	.180 - .220	6.5	103
Ca	2.02	2.00	1.80 - 2.20	1.0	---
Cu	.200	.200	.180 - .220	0	96
Fe	.206	.200	.180 - .220	3.0	121
Pb	.214	.200	.180 - .220	7.0	93

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QUALITY CONTROL STANDARDS (Cont'd)

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Mg	1.95	2.00	1.80 - 2.20	2.5	---
Mn	.202	.200	.180 - .220	1.0	95
K	9.7	10.0	9.0 - 11.0	3.0	82
SiO2	1.08	1.07	.96 - 1.18	1.0	93
Ag	1.07	1.00	.90 - 1.10	7.0	99
Hg	.007	.008	.006 - .009	13	100
Se	.020	.025	.017 - .028	22	---
As	.101	.100	.080 - .118	1	96
Conductance	1413	1413	-----	0	---
TDS	1496	1479	1331 - 1627	1	---
SO4	1059	1000	900 - 1100	6	---
Na	.79	.86	.76 - 96	7.0	---
Zn	.201	.200	.180 - .220	0.5	95
Gr. Alpha	186 ± 5	196	176 - 216	5.1	---
Gr. Beta	179 ± 2	173	156 - 190	3.5	---
Ra-226	104 ± 2	101	91 - 111	3.0	---
Th-230	107 ± 3	99	89 - 109	8.1	---
U	1.00	1.00	0.95 - 1.05	0	---

Approved by: _____

Rec. 2-14-90 GR

TO: GARY ZITO, BARRINGER LABORATORIES 2-13-90

FROM: LARRY CASEBOLT

SUBJECT: CHANGE OF ANALYSIS REQUIREMENTS FOR SAMPLE # HER059

GARY,

WOULD YOU USE THE ACCOMPANYING ANALYSIS FORM FOR SAMPLE # HER059 WHICH WAS DELIVERED TO THE COMBS' AIR TERMINAL MONDAY NIGHT AND RECEIVED BY YOUR REPRESENTATIVE ON TUESDAY MORNING.

THIS FORM IS TO REPLACE THE ONE SENT AS PART OF THE CHAIN OF CUSTODY AND ATTACHED TO THE ICE CHEST AS A PACKING LIST.

IF YOU HAVE ANY QUESTION PLEASE CALL ME AT (602) 643-7321

THANKS ALOT

LARRY CASEBOLT

ENERGY FUELS NUCLEAR, INC.

SAMPLE ANALYSIS INFORMATION

Perform those analysis marked with an X and circled

X	Ag	Total (Dissolved) Suspended	
X	As	Total (Dissolved) Suspended	
X	Ba	Total (Dissolved) Suspended	
	B	Total Dissolved Suspended	
X	Ca	Total (Dissolved) Suspended	
X	Cd	Total (Dissolved) Suspended	
X	Cr	(Total) Dissolved Suspended	X
X	Cu	Total (Dissolved) Suspended	
X	F	Total (Dissolved) Suspended	
X	Fe	Total (Dissolved) Suspended	
X	Pb	Total (Dissolved) Suspended	
X	Mg	Total (Dissolved) Suspended	
	Mo	Total Dissolved Suspended	
X	Mn	Total (Dissolved) Suspended	
X	Hg	Total (Dissolved) Suspended	
X	K	Total (Dissolved) Suspended	
X	Se	Total (Dissolved) Suspended	
X	Na	Total (Dissolved) Suspended	
X	Zn	Total (Dissolved) Suspended	
X	Alkalinity (as carbonate)		
X	Bicarbonate		
X	Carbonate		
X	Chloride		

X	pH	
X	Specific Cond. (micromhos per centimet	
X	TDS	
X	TSS	
X	NO_3 as N	
	NH_4 as N	
X	PO_4	
X	SO_4	
	SO_3	
X	SiO_2	
X	Gross Alpha*	(Total) (Dissolved) Suspende
X	Gross Beta*	(Total) (Dissolved) Suspende
	^{228}Ra*	Total Dissolved Suspended
X	^{226}Ra*	(Total) (Dissolved) Suspended
X	Total U_{nat}	Total Dissolved Suspended
	^{210}Pb*	Total Dissolved Suspended
	^{210}Po*	Total Dissolved Suspended
	^{234}U*	Total Dissolved Suspended
	^{235}U*	Total Dissolved Suspended
	^{238}U*	Total Dissolved Suspended
	^{228}Th*	Total Dissolved Suspended
X	^{230}Th*	(Total) (Dissolved) Suspended
	^{232}Th*	Total Dissolved Suspended
	^{40}K*	Total Dissolved Suspended

Units are mg/l unless otherwise noted

*Units are pCi/l



DESCRIPTION OF

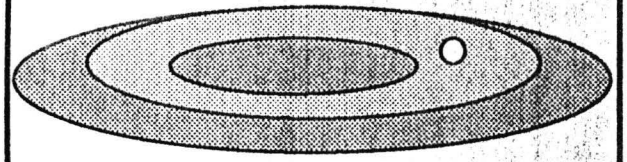
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INTRACID® RHODAMINE WT LIQUID

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- Time travel in streams

20% Solution

US	25 lb	3 gal	16.00/lb
	50 lb	6 gal	15.00/lb
	100 lb	12 gal	15.00/lb
Canada	250 lb	25 gal	14.00/lb

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It is the only known non-hazardous underwater detective. It is non-toxic to aquatic life, and was found by a recent independent study to be a de minimus health risk to humans.

The success rate of our sleuth is phenomenal for other reasons, too.

Intracid Rhodamine WT Liquid...

- is a bright fluorescent red dye developed specifically for water tracing
- exhibits high resistance to absorption onto organic and inorganic sediment
- has high fluorescence at a special wavelength
- According to the U.S. Army Corps of Engineers, it poses no known environmental or heath hazards
- is detectable at 0.1 ppb
- Is also used for estuarine flushing, subsurface water flow, water circulation patterns and other applications
- Recommended for city, county, state and Federal agencies as well as for industrial uses

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ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

REVIEW OF SHAFT AND RAISE CLOSURE PLAN AT THE HERMIT MINE OF ENERGY FUELS NUCLEAR, INC.

FEBRUARY, 1990

BEHRE DOLBEAR & COMPANY, INC.
1601 BLAKE STREET, SUITE 510
DENVER, COLORADO 80202
(303) 620-0020



PROJECT NO. D-0137

REVIEW OF SHAFT AND RAISE CLOSURE PLAN AT THE HERMIT MINE OF ENERGY FUELS NUCLEAR, INC.

INTRODUCTION

The Hermit Mine of Energy Fuels Nuclear, Inc. (EFNI), located in Section 17, T38N, R4W, Mohave County Arizona, is being closed because of depleted reserves. Part of Groundwater Quality Protection Permit No. G-0035-08 for the Hermit Mine reads as follows:

> "Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of a clay plug, a 40% clay/60% crushed shale plug or a bentonite plug in the main shaft, the air shaft and the monitoring well."

At the request of EFNI, a Behre Dolbear mining engineer visited the EFNI offices in Fredonia, Arizona on February 12, 1990 to review those portions of the EFNI mine closure plan relating to water containment and mine access. After a thorough review and discussions with members of the EFNI staff, a trip was made to the Hermit Mine to examine the locations where EFNI is proposing to place various plugs, a bulkhead, and fill material.

The person who made the examination was Richard Waissar, a mining engineer with 29 years of experience and a registered professional engineer in Colorado. Mr. Waissar is familiar with the geology and ground conditions in the area, having previously provided consulting services for parties other than EFNI at the Hack Canyon, Pigeon, and Kanab North Mines, which are in the same geologic environment.

PLAN DESCRIPTION

The EFNI closure plan is depicted in Figure 1. During the site visit it was observed that water was flowing from the Toroweap

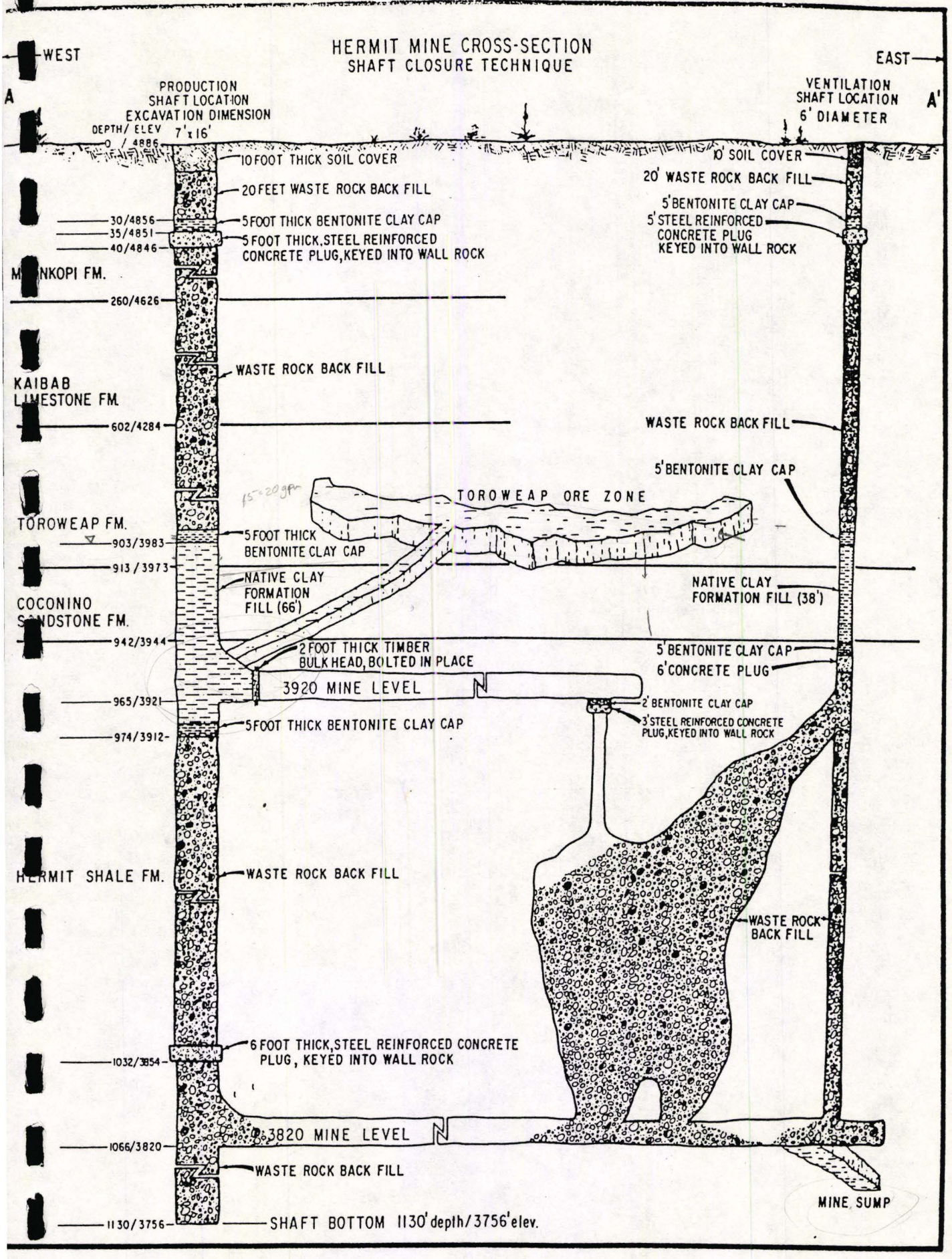

HERMIT MINE CROSS-SECTION
SHAFT CLOSURE TECHNIQUE
WEST
EAST
A
A'
PRODUCTION SHAFT LOCATION
EXCAVATION DIMENSION 7'x16'
DEPTH/ ELEV 0 / 4886
VENTILATION SHAFT LOCATION
6' DIAMETER
10 FOOT THICK SOIL COVER
20 FEET WASTE ROCK BACK FILL
30/4856
35/4851
40/4846
5 FOOT THICK BENTONITE CLAY CAP
5 FOOT THICK, STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
10' SOIL COVER
20' WASTE ROCK BACK FILL
5' BENTONITE CLAY CAP
5' STEEL REINFORCED CONCRETE PLUG KEYED INTO WALL ROCK
M NKOPI FM.
260/4626
WASTE ROCK BACK FILL
KAIBAB LIMESTONE FM.
602/4284
WASTE ROCK BACK FILL
5' BENTONITE CLAY CAP
TOROWEAP ORE ZONE
TOROWEAP FM.
903/3983
5 FOOT THICK BENTONITE CLAY CAP
913/3973
NATIVE CLAY FORMATION FILL (66')
NATIVE CLAY FORMATION FILL (38')
COCONINO SANDSTONE FM.
942/3944
2 FOOT THICK TIMBER BULK HEAD, BOLTED IN PLACE
5' BENTONITE CLAY CAP
6' CONCRETE PLUG
3920 MINE LEVEL
965/3921
2' BENTONITE CLAY CAP
3' STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
974/3912
5 FOOT THICK BENTONITE CLAY CAP
HERMIT SHALE FM.
WASTE ROCK BACK FILL
WASTE ROCK BACK FILL
1032/3854
6 FOOT THICK, STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
3820 MINE LEVEL
1066/3820
WASTE ROCK BACK FILL
MINE SUMP
1130/3756
SHAFT BOTTOM 1130' depth/3756' elev.

FIGURE 1

ore zone down the incline and into the production shaft at a rate estimated to be 15-20 gallons per minute. The objective of the EFNI plan is to isolate this flow and flows from the Coconino Sandstone, which underlies the Toroweap formation, from lower geologic units. The next lower known aquifer is located in the Muav limestone which is separated from the Coconino sandstone by 1800 feet of other sedimentary rocks. Of particular interest is the Hermit shale, a relatively tight, impermeable shale approximately 30 feet below the Toroweap formation and about 1800 feet above the Muav limestone. Klinkenberg permeability tests performed on core samples of the Hermit shale taken at the mine showed an estimated vertical permeability below the detection level of the equipment, or at least 10^{-11} cm/sec. The bottom of the production shaft and the mine sump are in this shale. The various geologic structures are shown in Figure 2.

R/M aquifer is in Suprise Canyon Conglomerate not Muav

Referring once again to Figure 1, the sequence of the EFNI plan is as follows:

1. Drill and blast keyway excavation in production shaft at 3854 elevation.
2. Fill shaft with waste rock to 3854 elevation.
3. Pour 6-foot steel-reinforced concrete plug at key location.
4. After concrete plug cures sufficiently, fill shaft with waste rock backfill to 3912 elevation.
5. Place a 5-foot layer of bentonite at 3912 elevation.
6. Widen mouth of raise at end of 3920 level.
7. Pour 3-foot thick, steel-reinforced concrete plug beginning 5 feet below mouth of raise.
8. Place 2-foot thick layer of bentonite on top of concrete raise plug.
9. Construct 2-foot thick timber bulkhead in 3920 level to seal off shaft from level.

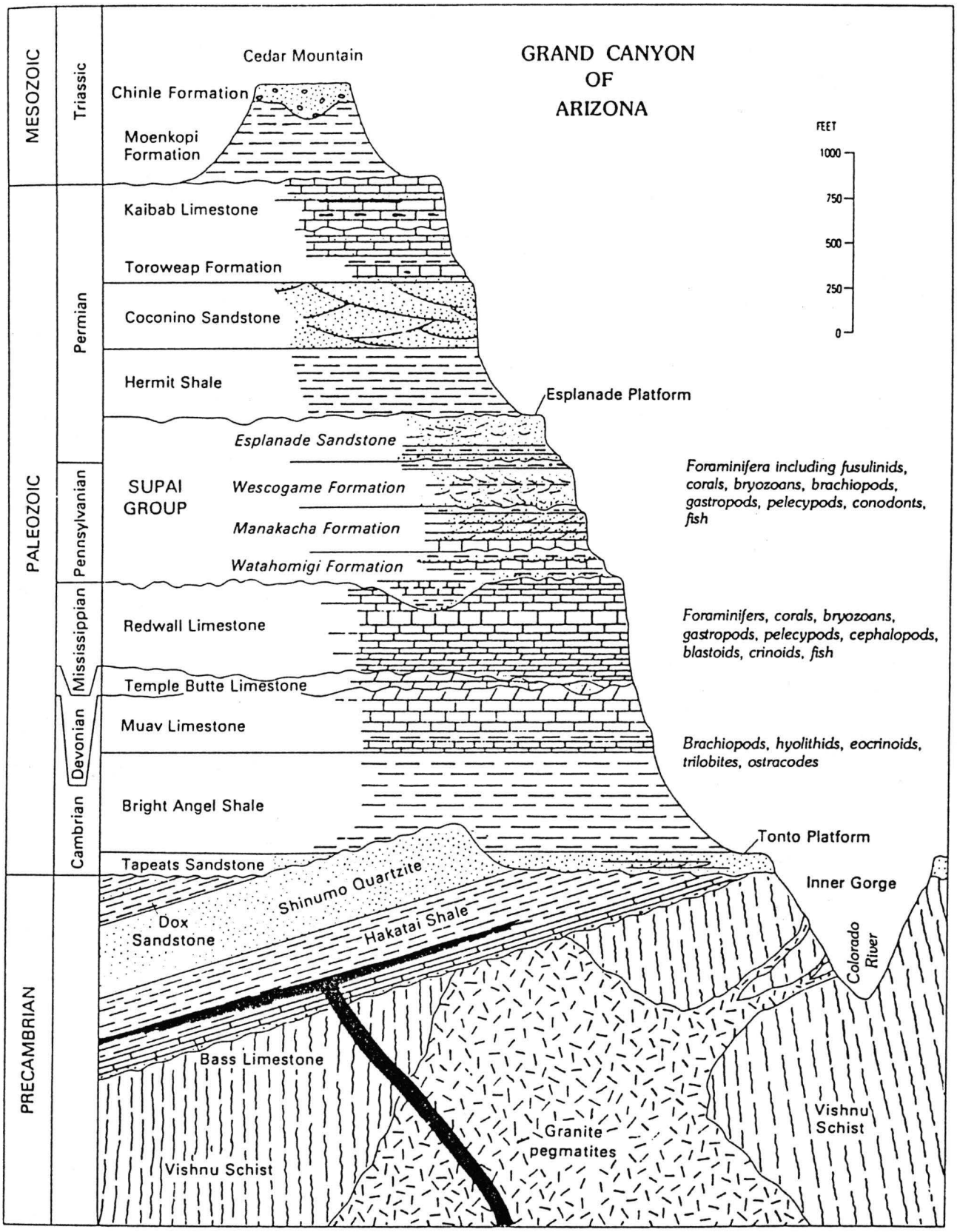

GRAND CANYON
OF
ARIZONA
MESOZOIC
PALEOZOIC
PRECAMBRIAN
Triassic
Permian
Pennsylvanian
Mississippian
Devonian
Cambrian
Cedar Mountain
Chinle Formation
Moenkopi Formation
Kaibab Limestone
Toroweap Formation
Coconino Sandstone
Hermit Shale
Esplanade Platform
Esplanade Sandstone
SUPAI GROUP
Wescogame Formation
Manakacha Formation
Watahomigi Formation
Redwall Limestone
Temple Butte Limestone
Muav Limestone
Bright Angel Shale
Tapeats Sandstone
Tonto Platform
Inner Gorge
Shinumo Quartzite
Dox Sandstone
Hakatai Shale
Colorado River
Bass Limestone
Vishnu Schist
Granite pegmatites
Vishnu Schist
FEET
1000
750
500
250
0
Foraminifera including fusulinids, corals, bryozoans, brachiopods, gastropods, pelecypods, conodonts, fish
Foraminifers, corals, bryozoans, gastropods, pelecypods, cephalopods, blastoids, crinoids, fish
Brachiopods, hyolithids, eocrinoids, trilobites, ostracodes

FIGURE 2

10. Backfill shaft and portion of shaft station at 3920 level with Moenkopi derived soil obtained from surface excavations (called "native clay formation fill" in Figure 1).
11. Place 5-foot thick bentonite clay cap on top of Moenkopi material at 3983 elevation.
12. Fill shaft to 4846 elevation with waste rock.
13. Drill and blast 5-foot keyway at 4846 elevation.
14. Pour 5-foot thick, steel-reinforced concrete plug at 4846 elevation. NOTE: The purpose of this plug is to prevent surface subsidence and to assist in the prevention of surface water inflows.
15. Place 5-foot thick bentonite plug on top of concrete plug.
16. Fill shaft to within 10 feet of surface with waste rock.
17. Fill remaining portion of production shaft with surface soil.
18. Fill ventilation shaft and stope with waste rock to a point approximately 11 feet below the Coconino sandstone.
19. Using a concrete bucket suspended from a cable, pour a 6-foot thick concrete plug on top of the rock fill. NOTE: The ventilation shaft was bored by machine. The walls, although relatively smooth, are typically sufficiently grooved by the reamer employed in making the opening to promote a good bonding action between the shaft walls and the concrete.
20. Place 5 feet of bentonite on top of concrete plug.
21. Fill shaft with 38 feet of "native clay formation" to seal off Coconino sandstone.
22. Place 5 feet of bentonite on top of native clay.
23. Fill ventilation shaft with waste rock to within 35 feet of surface.
24. Drill and blast 10-foot diameter keyway at 4846 elevation.

25. Pour 5-foot, steel-reinforced concrete plug.
26. Place 5 feet of bentonite on top of concrete.
27. Fill shaft with waste rock to within 10 feet of surface.
28. Fill remaining portion of shaft with surface soil.

The shaft plug at the 3854 elevation will be poured on a wooden platform supported by steel beams which now form part of an existing shaft set. The raise plug will be poured on timbered lagging. All other concrete plugs will be poured directly on rock backfill. Sketches prepared by an EFNI engineer showing rebar size and spacing, concrete specifications, and plug dimensions are attached to this report.

While at the site, a visual examination was made of the Moenkopi derived soil to be placed in the shafts. The material appeared to have high clay and shale contents, which should make it suitable for its intended purpose. Laboratory tests on samples of the material to determine its suitability are currently being performed by the firm of Chen Northern, Inc. in Denver. The test results, however, were not yet available at the time this report was prepared.

CONCLUSIONS

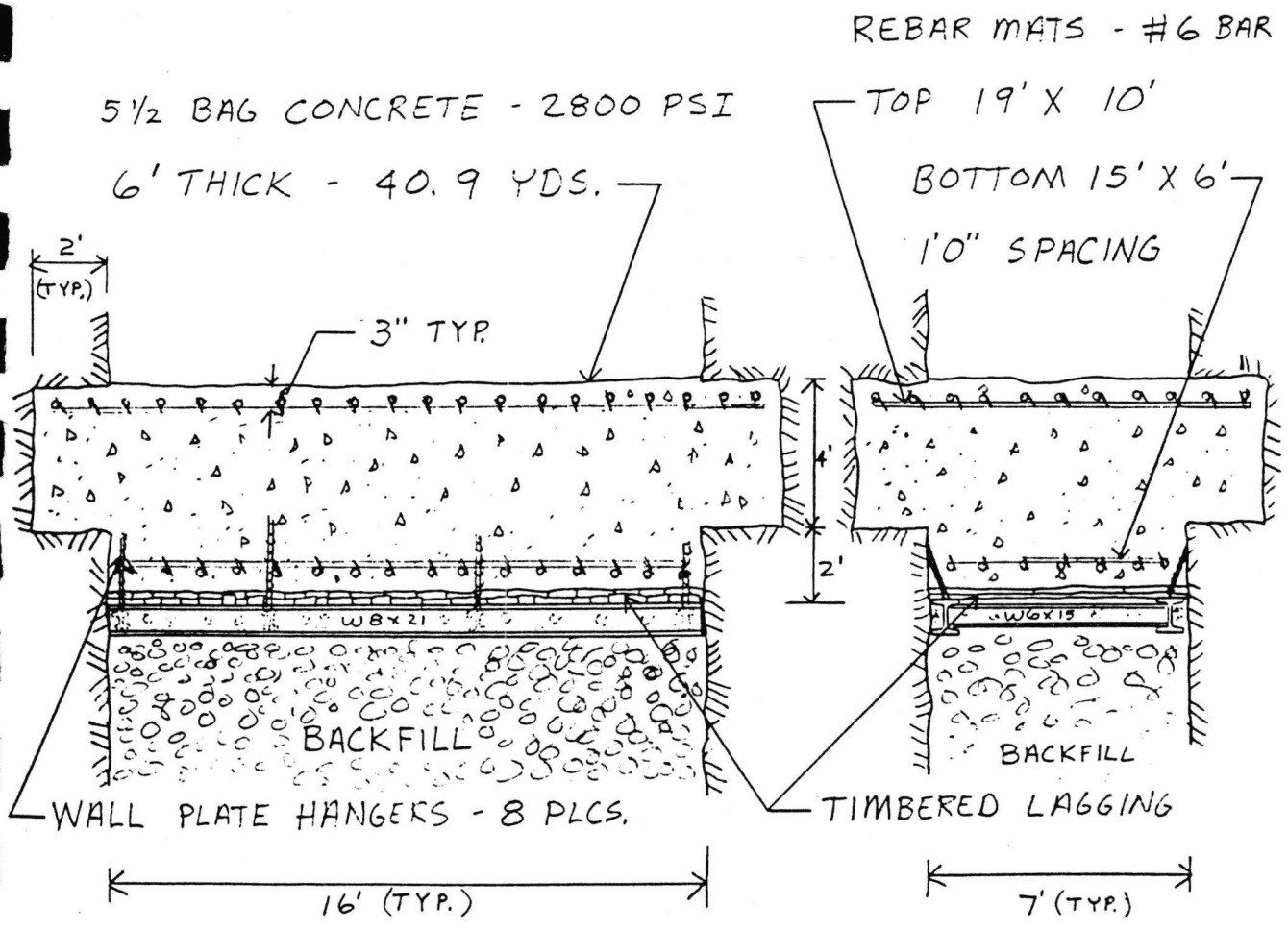
It is the opinion of Behre Dolbear that EFNI closure plan for the Hermit Mine meets or exceeds the requirements of Groundwater Quality Protection Permit No. G-0035-08. Migration of any mine inflow to the Muav limestone is essentially precluded by the fact that the two shafts bottom in the tight Hermit shale which should preclude any possible intermingling of aquifer waters. Further protection is afforded by the design of the concrete plugs and bentonite caps which are more than adequate to insure compliance with the permit requirements. Finally, the apparent clay content of the Moenkopi derived soil should insure the isolation of the Toroweap-Coconino formations from the lower geologic units.

SHAFT PLUG - 3854 LEVEL

SCALE 1" = 50'

SHAFT SIZE: 16' X 7'

KEYWAY SIZE: 20' X 11'

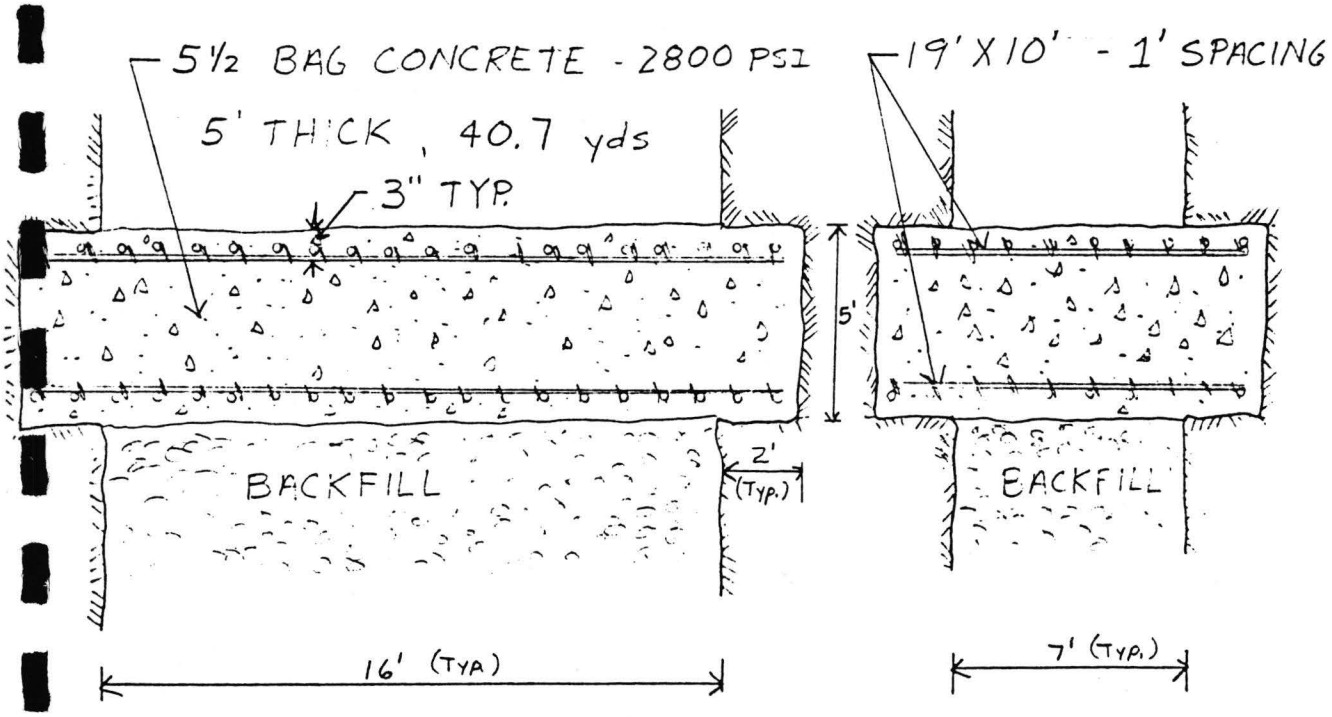


SHAFT PLUG 4846 LEVEL

SHAFT SIZE : 16' X 7'

SCALE 1" = 50'

KEYWAY SIZE : 20' X 11'

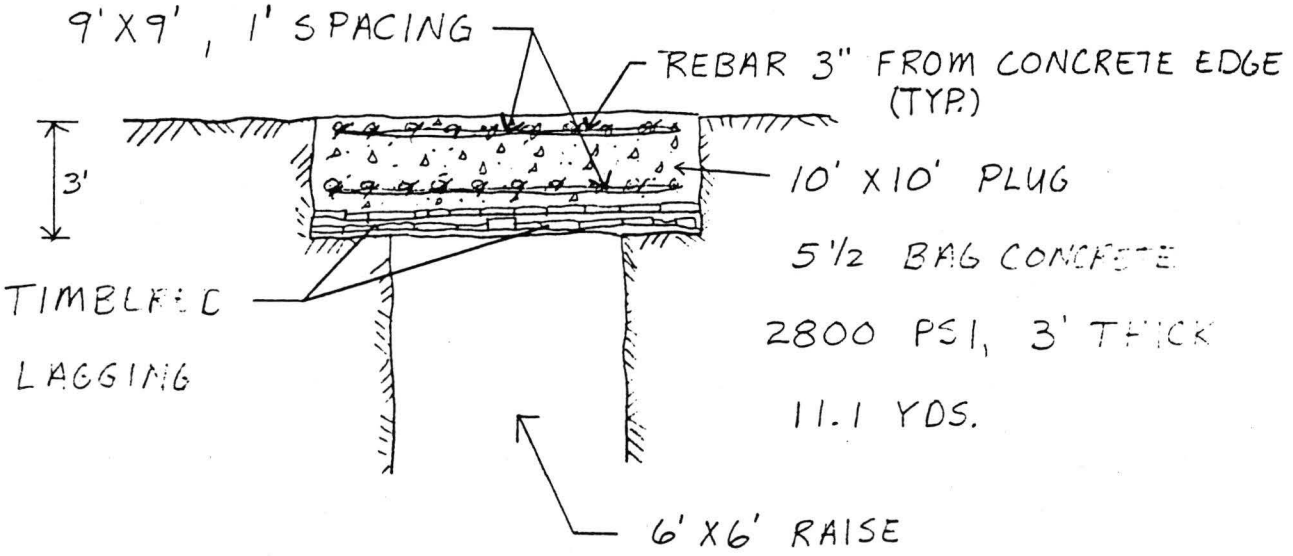


RAISE PLUG 3920 LEVEL

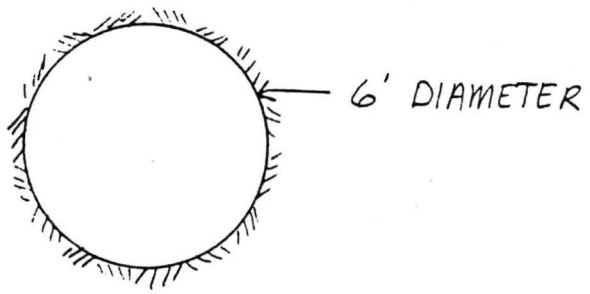
6' X 6' RAISE

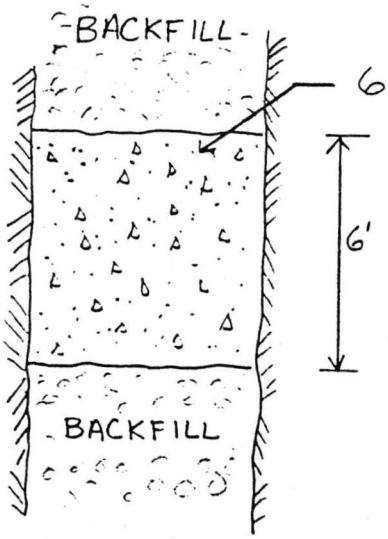
SCALE 1" = 50'

REBAR MAT, #6, TOP & BOTTOM,
9'X9', 1' SPACING



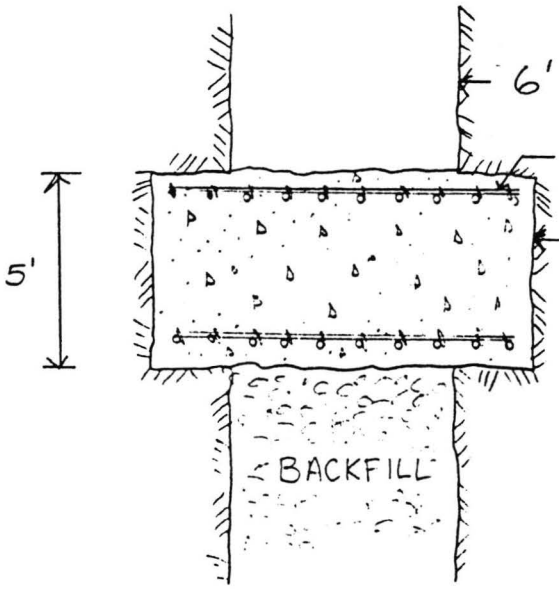
VENTILATION SHAFT PLUG - 3930 LEVEL





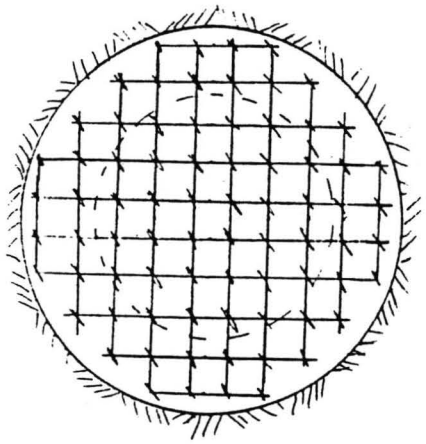
5½ BAG, 2800 PSI
6.3 yds.

VENTILATION SHAFT PLUG, 4846 LEVEL



5' CONCRETE PLUG, 2800 PSI

5½ BAG, 14.5 YDS.



REBAR MAT, TOP AND BOTTOM

1' BAR SPACING, #6 REBAR

HERMIT MINE
GROUNDWATER MONITORING REPORT
MINING PHASE

SUBMITTED TO
ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

BY
ENERGY FUELS NUCLEAR, INC.

FEBRUARY 12, 1990



Hermit Mine
Groundwater Monitoring Report
Mining Phase

Introduction

The Hermit Mine operates under the terms and conditions of the Hermit Mine Groundwater Protection Permit #G-0035-08. Section II.B.1.b. of the Permit outlines groundwater monitoring actions which must be taken during the mining phase of operations. This report presents and summarizes data collected during the mining phase.

Table I lists the dates, types and purposes of samples included within this report.

Discharge Monitoring

The Hermit Mine Facility was designed as a non-discharging facility. The surface facilities associated with the mine have been designed so that all surface water drains to lined surface impoundments. Mine water produced during mining operations has been pumped to the lined surface impoundments for evaporation or for use within the mine operations area for dust suppression.

A septic system with an associated leach field has been constructed at the Hermit Mine for disposal of sewage and wash water only. In compliance with provisions of the Groundwater Protection Permit, septic system effluent is sampled on an annual basis and analyzed for the parameters listed in II.B.2.b.

An annual septic system sample was obtained by bailing from the septic tank through the clean-out port. Analytical results are presented as Attachment I to this report.

Impoundment Monitoring

The lined evaporation ponds are inspected visually on a daily basis by mine personnel. Once a month a formal inspection is performed by the Mine Superintendent and documented on a Safety and Environment Inspection Form. No mechanical damage to the liner has been detected. Adequate freeboard has been maintained throughout the mining operation.

TABLE I

Summary of Mining Phase Groundwater Samples

Sample Rate	Sample Number	Sample Purposes	Sampling Parameters	Monitor Period
06-27-89	HER 043	Mine Sump	II.B.2.b	2nd Quarter
06-29-89	HER 044	Monitor Well	II.B.2.a	2nd Quarter
06-27-89	HER 045	Shaft Sample	II.A.2.b	2nd Quarter
09-21-89	HER 048	Monitor Well	II.A.2.b	3rd Quarter
09-21-89	HER 049	Sump Sample	II.A.2.b	3rd Quarter
09-21-89	HER 050	Shaft Sample	II.A.2.b	3rd Quarter
10-19-89	HER 051	Confirmation Sample	II.A.2.b	2nd Quarter
10-02-89	HER 1S-45	Septic Sample	II.A.2.b	Annual

Groundwater Monitoring

Groundwater monitoring of the water supply/monitoring well, Department of Water Resources Well Registry #55-518877 has taken place on a quarterly basis during the mining phase. Samples HER 044 and HER 048 represent Second and Third Quarter, 1989 sampling data. Results are included in Attachment II.

Sample HER 044 was sampled for the list of parameters listed in II.B.2.a (Indicator Parameters), as per requirements of the Groundwater Protection Permit. It was determined after review of HER 044 that sample analysis indicated concentrations of iron (Fe), manganese (Mn) and uranium (U) in excess of maximum groundwater limits as established in the premining period (Refer to Hermit Mine Premining Water Quality Report). A confirmation sample for the comprehensive list of parameters contained in Part II.B.2.b was then taken on October 19, 1989 and is identified as HER 051. HER 051 results are contained within Attachment II.

Water Quality Results

Table II, Mining Water Quality Results, presents a comparison of monitor well water quality analysis results (HER 044, 048 and 051) to maximum groundwater limits as determined following procedures in the Groundwater Protection Permit.

Concentrations of Mn and U have consistently exceeded maximum groundwater limits for the three samples for which sample results are available. Additionally, magnesium, potassium, sodium, gross beta and electrical conductivity exceeded maximum groundwater limits in the HER 051 sample.

Several possible explanations for the exceedances exist. The most likely explanation is that increased sediment from the well field has resulted in increased levels of radionuclides and other constituents within well water. According to field personnel responsible for sample collection, a noticeable change in the amount of suspended solids occurred during January and February, 1989.

Could be due to Fe precipitating back out of solution

The color of well water changed from nearly clear to red in color. The red color is apparently due to increased silt and fine sand from the Redwall-Mauv formation. The increased suspended solids could indicate that continued pumping of the well for operational purposes is resulting in increased fine sediment from the production zone within the Redwall-Mauv aquifer. Possible sources of fine sediment and sand are silty sandstone layers within the Redwall-Mauv formation. The existence of these layers is well documented in Billingsley (1985). The introduction of additional suspended sediment may be a source of higher concentrations of some chemical constituents in monitoring samples. Additionally, since radionuclides are analyzed for total concentrations (dissolved and suspended constituents), increases in sediment contribute to greater concentrations.

In order to test this theory, two Hermit Mine monitor well samples have been analyzed again for both dissolved and total uranium concentrations. Comparison of uranium analyzed for both dissolved and total uranium within the same sample shows dramatic reduction in uranium content when considering only dissolved uranium. The Fourth Quarter, 1989 groundwater monitoring well sample (HER 052; submitted under separate cover) indicates dissolved uranium at a concentration of 0.003 mg/l. Total uranium is shown as 0.024 mg/l. The concentration of 0.003 mg/l is within maximum groundwater limits. Also, reanalysis of sample HER 048 indicates a similar reduction in uranium concentrations from 0.0041 mg/l total uranium to 0.0011 mg/l dissolved uranium.

Sampling and/or analytical procedures and variability are other sources of possible error. Groundwater monitoring samples are collected following procedures outlined in the Groundwater Protection Permit and recommended sampling protocols outlined in EPA publication EPA/600/2-85/104, "Practical Guide for Groundwater Sampling". Sampling procedures include appropriate field filtering with a 0.45 micron filter after voiding the well casing volume, preservation of samples with appropriate

stabilizing chemic , cooling of samples to low 4°C and usual holding times between laboratory and sampling of between 12 and 48 hours. Also, Chain of Custody forms are completed and maintained as documentation. Sampling error has been minimized through adherence to these procedures.

The accuracy of analytical techniques and equipment is another possible source of error. Parameters indicating concentration increases in the 0.1, 0.01 or 0.001 of a mg/l must be viewed in the context of the accuracy and variability of equipment and laboratory techniques. Individual sample analysis can not be viewed as a reliable indicator of real trends in groundwater quality at negligible concentration levels. Only repeated sampling with adequate quality control can be relied upon to show real trends.

TABLE III
Mine Inflow During Mining

Month/1989	Total Volume (Gallons)
June	527,800
July	660,672
August	678,528
September	777,600
October	758,880
November	734,400
December	669,600

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

17-May-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Attn:
Project:

PO #:

Received: 2-Apr-90 16:37

Job: 902181E

Status: Final

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Cl	25.26	26.05	24.1 - 27.7	3.1	---
NO3	2.08	1.98	1.78 - 2.18	4.9	71
F	.51	.50	.45 - .55	2.0	---
PO4	.53	.50	.46 - .54	5.8	---
Cond.	1413	1413	----	0	---
As	.102	.100	.080 - .118	2	---
Hg	.005	.005	.004 - .006	0	---
Se	.021	.025	.017 - .028	17	---
Cl	.208	.200	.180 - .220	4.0	101
Ba	1.08	1.00	.90 - 1.10	8.0	99
Cd	.212	.200	.180 - .220	6.0	107
Ca	2.07	2.00	1.80 - 2.20	3.5	---
Cu	.196	.200	.180 - .220	2.0	93
Fe	.203	.200	.180 - .220	1.5	---
Pb	.209	.200	.180 - .220	4.5	93
Mg	1.98	2.00	1.80 - 2.20	1.0	---
Mn	.207	.200	.180 - .220	3.5	125
K	10.2	10.0	9.0 - 11.0	2.0	78
Ag	1.02	1.00	.90 - 1.10	2.0	91
Na	.78	.86	.76 - .96	8	---
Zn	.204	.200	.180 - .220	2.0	105
TDS	1434	1479	1331 - 1627	3.1	---
SO4	1063	1000	900 - 1100	6.1	---
SiO2	1.06	1.07	.96 - 1.18	1.0	81
Gr. Alpha	190 ± 5	196	176 - 216	3.1	---
Gr. Beta	171 ± 2	173	156 - 190	1.2	---
Ra-226	106 ± 3	101	91 - 111	5.0	---
Th-230	89 ± 2	96	86 - 106	7.3	---
U	35	34	31 - 37	2.9	---

Approved by: _____

SEND TO: BARRINGER LABORATORIES INC.
15000 W. 6TH AVE. SUITE 300
GOLDEN, COLO. 80401

SENT FROM:

CHAIN OF CUSTODY RECORD - CLIENT COPY

Sampler's Name: L. CASEBOLT
Company Name: ENERGY FUELS NUCLEAR INC.
Company Address: _____

I.D. #	Client I.D. #	Sample Location	Date/Time of Sampling	Raw, Unfiltered, Plastic	Raw, Filtered, Plastic	Raw, Filtered, Glass	HNO_3, Filtered, Plastic	H_2SO_4, Filtered, Plastic	NaOH + ZN Acetate, Filtered, Plastic			Total Number of Bottles	(Instructions for Analysis on back of form) Comments
	HERO61	HERMIT MINE WATER WELL		1			1	1	1			4	
	PNO60	PINENUT MINE WATER WELL		1			1	1	1			4	

Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Date/Time
L. Casebolt	3/28/90 5:30 P.M.	Barbara Hines	4/2/90 8:30
Relinquished By: (Signature)	Date/Time	Received for BLI By: (Signature)	Date/Time

Shipping Information
Carrier: UPS
Date Shipped: 3-29-90

SAMPLE ANALYSIS INFORMATION

Perform those analysis marked with an X and circled

X	Ag	Total **Dissolved** Suspended
X	As	Total **Dissolved** Suspended
X	Ba	Total **Dissolved** Suspended
	B	Total Dissolved Suspended
X	Ca	Total **Dissolved** Suspended
X	Cd	Total **Dissolved** Suspended
X	Cr	**Total** Dissolved Suspended
X	Cu	Total **Dissolved** Suspended
X	F	Total **Dissolved** Suspended
X	Fe	Total **Dissolved** Suspended
X	Pb	Total **Dissolved** Suspended
X	Mg	Total **Dissolved** Suspended
	Mo	Total Dissolved Suspended
X	Mn	Total **Dissolved** Suspended
X	Hg	Total **Dissolved** Suspended
X	K	Total **Dissolved** Suspended
X	Se	Total **Dissolved** Suspended
X	Na	Total **Dissolved** Suspended
X	Zn	Total **Dissolved** Suspended
X	Alkalinity (as carbonate)	
X	Bicarbonate	
X	Carbonate	
X	Chloride	

X	pH	
X	Specific Cond. (micromhos per centimeter	
X	TDS	
X	TSS	
X	NO_3 as N	
	NH_4 as N	
X	PO_4	
X	SO_4	
	SO_3	
X	SiO_2	
X	Gross Alpha[a]	**Total** **Dissolved** Suspended
X	Gross Beta[a]	**Total** **Dissolved** Suspended
	^{228}Ra[a]	Total Dissolved Suspended
X	^{226}Ra[a]	**Total** **Dissolved** Suspended
X	Total U_{nat}	**Total** **Dissolved** Suspended
	^{210}Pb[a]	Total Dissolved Suspended
	^{210}Po[a]	Total Dissolved Suspended
	^{234}U[a]	Total Dissolved Suspended
	^{235}U[a]	Total Dissolved Suspended
	^{238}U[a]	Total Dissolved Suspended
	^{228}Th[a]	Total Dissolved Suspended
X	^{230}Th[a]	**Total** **Dissolved** Suspended
	^{232}Th[a]	Total Dissolved Suspended
	^{40}K[a]	Total Dissolved Suspended

Units are mg/l unless otherwise noted

[a]Units are pCi/l

SECOND QUARTER, 1990

GROUNDWATER MONITOR WELL

ANALYTICAL RESULTS

BARRINGER LABORATORIES INC.

18000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1166

22-Jun-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 1
Copy: 2 of 3
Set : 1

Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

Sample Type: Water

Sample	Ag Dissolved mg/l	As Dissolved mg/l	Ba Dissolved mg/l	Ca Dissolved mg/l	Cd Dissolved mg/l	Cr Total mg/l
HER064	<0.01	<0.001	0.01	610	0.007	<0.01

Sample	Cu Dissolved mg/l	F mg/l	Fe Dissolved mg/l	Pb Dissolved mg/l	Mg Dissolved mg/l	Mn Dissolved mg/l
HER064	<0.01	1.4	13.2	<0.02	186	0.18

Sample	Hg Dissolved mg/l	K Dissolved mg/l	Se Dissolved mg/l	Na Dissolved mg/l	Zn Dissolved mg/l	Alkalinity as CaCO3 mg/l
HER064	<0.0002	22.5	<0.001	82.6	<0.005	170

Sample	HCO3 as CaCO3 mg/l	CO3 as CaCO3 mg/l	Cl mg/l	pH unit	Specific Conductance µmho/cm	TDS mg/l	TSS mg/l
HER064	170	<1	41	8.06	3318	3320	93

Sample	NO3 as N mg/l	PO4 as P mg/l	SO4 mg/l	SiO2 Dissolved mg/l	Gross Alpha Error Dissolved pCi/l	2σ*
HER064	<0.1	0.3	1150	13.3	12	±14

Sample	Gross Beta Error Dissolved pCi/l	2σ*	Gross Alpha Error Total pCi/l	2σ*	Gross Beta Error Total pCi/l	2σ*
HER064	37	±12	44	±18	35	±12

BARRINGER LABORATORIES INC.

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22-Jun-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 2
Copy: 2 of 3
Set : 1

Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

Sample Type: Water

Sample	Ra-226 Dissolved pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*
HER064	1.7	±0.5	2.0	±0.7	0.9	±0.6	1.0	±0.9

Sample	U Dissolved mg/l	U Total mg/l
HER064	0.0008	0.0082

BARRINGER LABORATORIES INC.

16000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1466 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1160

22-Jun-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 3
Copy: 2 of 3
Set : 1

Attn:
Project:

PO #:

Received: 18-May-90 15:35

Job: 902490E

Status: Final

Abbreviations:

Parameters:

Ag	: Silver
As	: Arsenic
Ba	: Barium
Ca	: Calcium
Cd	: Cadmium
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
K	: Potassium
Se	: Selenium
Na	: Sodium
Zn	: Zinc
HCO3	: Bicarbonate
CO3	: Carbonate
Cl	: Chloride
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
NO3 as N	: Nitrate
PO4 as P	: Phosphate
SO4	: Sulfate
SiO2	: Silica
Ra-226	: Radium-226
Th-230	: Thorium-230

BARRINGER LABORATORIES INC.

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SPARKS, NEVADA 89431
PHONE: (702) 356-1158

22-Jun-90

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Page: 4
Copy: 2 of 3
Set : 1

Attn:
Project:

Received: 18-May-90 15:35

PO #:

Job: 902490E

Status: Final

U : Uranium

Units:

mg/l : milligrams per liter
µmho/cm : micromhos per centimeter at 25C
pCi/l : picoCuries per liter
2σ* : * Counting error at the 95% confidence level, 2σ

Quality control:

< : less than

Signed:

.....

Gary Zito
Laboratory Supervisor



FIRST QUARTER, 1990

SPLIT SAMPLE

ANALYTICAL RESULTS

ACCU-LABS RESEARCH, INC.

11485 West 48th Avenue - Wheat Ridge, CO 80033 - (303) 423-2766

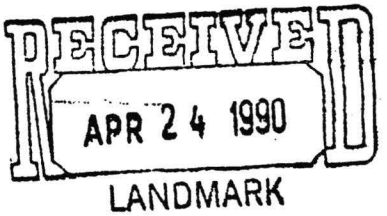
A N A L Y S I S R E P O R T

DATE: 04/20/90 PAGE 1

BILL ALNAS
ENERGY FUELS NUCLEAR
2555 N. HIGHWAY 89A
FREDONIA, AZ 86022

Lab Job Number: 9813-33670-1
Date Samples Received: 04/02/90
Customer PO Number: 27883

Copy To:
BILL ALNAS
ENERGY FUELS NUCLEAR
1 TABOR CENTER, SUITE 2500
1200 17TH. ST.
DENVER, CO 80202



These samples to be disposed of 30 days after the date of this report.

ALR Designation -	9813-33670-1-1
Sponsor Designation -	HERO 62
Date Collected -	03/28/90

Determinations in mg/L unless noted

Barium - dissolved	<0.05
Cadmium - dissolved	<0.005
Calcium - dissolved	510
Chromium - total	0.12
Copper - dissolved	0.072
Iron - dissolved	86
Magnesium - dissolved	200
Manganese - dissolved	1.1
Mercury - dissolved	<0.0001
Potassium - dissolved	22
Silica-ICP - dissolved	5.9
Silver - dissolved	<0.005
Sodium - dissolved	69
Zinc - dissolved	0.023
Alkalinity, Total (as CaCO3 to ph 4.5)	150

ACCU-LABS RESEARCH, INC.
A N A L Y S I S R E P O R T
DATE: 04/20/90 PAGE 2
Lab Job Number 9813-33670-1

These samples to be disposed of 30 days after the date of this report.

ALR Designation -	9813-33670-1-1
Sponsor Designation -	HERO 62
Date Collected -	03/28/90

Determinations in mg/L unless noted

Carbonate (as CO3)	<5
Bicarbonate (as HCO3)	180
pH (pH Units)	7.4
Specific Conductance (µmhos/cm)	3,500
Arsenic - dissolved	<0.01 [9]
Lead - dissolved	<0.005
Selenium - dissolved	<0.005
Nitrate (as N)	<0.05
Orthophosphate (as P)	0.07
Total Dissolved Solids (@180 °C)	3,400
Total Suspended Solids (@105 °C)	280
Chloride	48
Fluoride	1.6
Sulfate (as SO4)	2,000

Notes:
[9] -- HIGHER D.L. DUE TO SAMPLE MATRIX INTERFERENCE

By: Mary Fabisiak
Mary Fabisiak
Water Laboratory Supervisor

MF/dh dh

ACCU-LABS RESEARCH, INC.

11485 West 48th Avenue - Wheat Ridge, CO 80033 - (303) 423-2766

CORRECTED REPORT

A N A L Y S I S R E P O R T

DATE: 06/27/90 PAGE 1

BILL ALMAS
ENERGY FUELS NUCLEAR
2555 N. HIGHWAY 89A
FREDONIA, AZ 86022

Lab Job Number: 9813-33670-1
Date Samples Received: 04/02/90
Customer PO Number: 27883

Copy To:
BILL ALMAS
ENERGY FUELS NUCLEAR
1 TABOR CENTER, SUITE 2500
1200 17TH. ST.
DENVER, CO 80202

These samples to be disposed of 30 days after the date of this report.

ALR Designation -	9813-33670-1-1
Sponsor Designation -	HERO 62
Date Collected -	03/28/90

Determinations in pCi/L unless noted

Gross Alpha - dissolved	6 ± 20 *
Gross Alpha - total	12 ± 20 *
Gross Beta - dissolved	25 ± 16 *
Gross Beta - total	26 ± 16 *
Radium-226 - dissolved	6.1 ± 0.4 *
Radium-226 - total	8.0 ± 0.4 *
Thorium-230 - dissolved	0.3 ± 0.2 *
Thorium-230 - total	0.5 ± 0.3 *
Uranium - dissolved (mg/L)	<0.001
Uranium - total (mg/L)	0.005

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.

By: Bud Summers
Radiochemistry Supervisor

BS/dh dh

FIRST QUARTER, 1990

MINE SUMP ANALYTICAL RESULTS

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PHONE: (702) 358-1158

22-Mar-90

Bill Almas
ENERGY FUELS NUCLEAR
One Tabor Center
1200 17th Street
Suite 2500
Denver, CO 80202

Page: 1
Copy: 3 of 3
Set : 1

Attn:
Project:

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Purchase order :

Job: 901962E

Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	As Dissolved mg/l	Ba Dissolved mg/l	CO3 as CaCO3 mg/l	Cd Dissolved mg/l
HER 059	196	0.266	<0.01	196	<0.005

Sample	Ca Dissolved mg/l	Cl mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Dissolved mg/l	F mg/l
HER 059	513	30	<0.01	3190	<0.01	1.1

Sample	Fe Dissolved mg/l	Pb Dissolved mg/l	Mg Dissolved mg/l	Mn Dissolved mg/l	Hg Dissolved mg/l
HER 059	0.11	0.04	168	0.04	<0.0002

Sample	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Dissolved mg/l	Se Dissolved mg/l	SiO2 Dissolved mg/l
HER 059	6.0	7.74	<0.1	27.5	0.008	9.9

Sample	Ag Dissolved mg/l	Na Dissolved mg/l	TDS mg/l	TSS mg/l	SO4 mg/l	Zn Dissolved mg/l
HER 059	0.01	76.6	3290	11	2180	0.094

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Status: Final

Sample Type: Water

Sample	Gross Alpha Dissolved pCi/l	Error 2σ*	Gross Beta Dissolved pCi/l	Error 2σ*	Gross Alpha Suspended pCi/l	Error 2σ*
HER 059	5500	±100	1190	±30	750	±20

Sample	Gross Beta Suspended pCi/l	Error 2σ*	Ra-226 Dissolved pCi/l	Error 2σ*	Ra-226 Suspended pCi/l	Error 2σ*
HER 059	1040	±10	210	±10	83	±3

Sample	Th-230 Dissolved pCi/l	Error 2σ*	Th-230 Suspended pCi/l	Error 2σ*	U Dissolved mg/l	U Suspended mg/l
HER 059	0.5	±0.6	100	±10	4.29	0.243

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Status: Final

Pending analyses:

CO3//mg/l

Abbreviations:

Analyses:

As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
TSS	: Total Suspended Solids
SO4	: Sulfate
Zn	: Zinc

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Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Abbreviations:

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

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Project:

Received: 13-Feb-90
Purchase order :

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Status: Final

QUALITY CONTROL DATA SHEET

Time Received: Date: 2/13/90 By: Receiving Via: Picked up

Sample Container Type: large cube
Sample Type: water
Preservative When Received: 1. HNO3 2. H2SO4 3. None 4. NaOH/ZnoAc
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
F	1	340.2	.05 mg/l	3	Acree	2/16
Cl	1	325.2	1 mg/l	3	Hobbs	2/16
PO4	1	365.1	.1 mg/l	3	Hobbs	2/20
NO3	1	353.1	.1 mg/l	2	Hobbs	12/21
Cr	1	200.7	.01 mg/l	1	Hidalgo	2/22
Ba	1	200.7	.01 mg/l	1	Hidalgo	2/22
Cd	1	200.7	.005 mg/l	1	Hidalgo	2/22
Ca	1	200.7	.01 mg/l	1	Hidalgo	2/22
Cu	1	200.7	.01 mg/l	1	Hidalgo	2/22
Fe	1	200.7	.01 mg/l	1	Hidalgo	2/22
Pb	1	200.7	.001 mg/l	1	Hidalgo	2/22
Mg	1	200.7	.01 mg/l	1	Hidalgo	2/22
Mn	1	200.7	.01 mg/l	1	Hidalgo	2/22
K	1	200.7	.5 mg/l	1	Hidalgo	2/22
SiO2	1	200.7	.01 mg/l	1	Hidalgo	2/22
Ag	1	200.7	.01 mg/l	1	Hidalgo	2/22
HCO3	1	210.1	1 mg/l	3	Acree	2/23
Hg	1	245.1	.0002 mg/l	1	Swanson	3/2
pH	1	150.1	.01 mg/l	3	Acree	2/23
Se	1	270.2	.001 mg/l	1	Gilleland	3/2
As	1	206.2	.001 mg/l	1	Gilleland	3/5
Conductance	1	1201	.001 mg/l	1	Hencmann	2/19

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Job: 901962E

Status: Final

QUALITY CONTROL DATA SHEET (Cont'd)

Parameter	Ref	Method	LLD	Preservatives	Analyst	Date(s) of Analysis
TDS	1	160.1	10 mg/l	3	Acree	2/19
SO4	1	375.3	5 mg/l	3	Acree	2/19
Na	1	200.7	.01 mg/l	1	Hidalgo	2/22
Zn	1	200.7	.005 mg/l	1	Hidalgo	2/22
TSS	1	160.2	4 mg/l	3	Acree	2/23
Gr. Alpha	4	900.0	1.0 pCi/l	3	Kidwell	2/26-3/12
Gr. Beta	4	900.0	2.0 pCi/l	3	Kidwell	2/26-3/12
Ra-226	4,7,14	SM-705	0.2 pCi/l	3	Howard	2/20-2/26
Th-230	11	---	0.2 pCi/l	3	Jackson	2/15-2/19
U	4,9,10,14	ASTMD2907	0.3 µg/l	3	Krizman	2/13-2/16

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER-059	F	1.12	1.15	3
"	Cl	30.3	30.3	0
"	PO4	<.1	<.1	0
"	NO3	6.2	6.2	0
"	Cr	<.01	<.01	0
"	Ba	<.01	<.01	---
"	Cd	<.005	<.005	0
"	Ca	513	537	4.5
"	Cu	<.01	<.01	0
"	Fe	.11	.11	0
"	Pb	.04	.02	---
"	Mg	168	175	4.6
"	Mn	.04	.04	0
"	K	27.5	28.7	4.1
"	Sio2	9.9	10.3	4.0
"	Ag	.01	<.01	---

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DUPLICATES (Cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER-059	HCO3	195.8	195.8	0
"	Hg	<.0002	<.0002	0
"	pH	7.74	7.78	.5
"	Se	.008	.008	0
"	As	.266	.272	2
"	Conductance	3192	3196	.1
"	TDS	3289	3282	.2
"	SO4	2184	2144	.2
"	Na	76.6	80.2	0.7
"	Zn	.094	.101	7.0
"	TSS	11	12	8.7

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
F	.50	.50	.45 - .55	0	---
Cl	26.5	26.05	24.1 - 27.7	2	---
PO4	.55	.50	.46 - .54	9.5	---
NO3	2.14	1.98	1.78 - 2.18	8	76
Cr	.197	.200	.180 - .220	1.5	79
Ba	.97	1.00	.90 - 1.10	3.0	94
Cd	.213	.200	.180 - .220	6.5	103
Ca	2.02	2.00	1.80 - 2.20	1.0	---
Cu	.200	.200	.180 - .220	0	96
Fe	.206	.200	.180 - .220	3.0	121
Pb	.214	.200	.180 - .220	7.0	93

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22-Mar-90

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Job: 901962E

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QUALITY CONTROL STANDARDS (Cont'd)

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
Mg	1.95	2.00	1.80 - 2.20	2.5	---
Mn	.202	.200	.180 - .220	1.0	95
K	9.7	10.0	9.0 - 11.0	3.0	82
SiO2	1.08	1.07	.96 - 1.18	1.0	93
Ag	1.07	1.00	.90 - 1.10	7.0	99
Hg	.007	.008	.006 - .009	13	100
Se	.020	.025	.017 - .028	22	---
As	.101	.100	.080 - .118	1	96
Conductance	1413	1413	-----	0	---
TDS	1496	1479	1331 - 1627	1	---
SO4	1059	1000	900 - 1100	6	---
Na	.79	.86	.76 - 96	7.0	---
Zn	.201	.200	.180 - .220	0.5	95
Gr. Alpha	186 ± 5	196	176 - 216	5.1	---
Gr. Beta	179 ± 2	173	156 - 190	3.5	---
Ra-226	104 ± 2	101	91 - 111	3.0	---
Th-230	107 ± 3	99	89 - 109	8.1	---
U	1.00	1.00	0.95 - 1.05	0	---

Approved by: _____

Rec. 2-14-90 GR

TO: GARY ZITO, BARRINGER LABORATORIES 2-13-90

FROM: LARRY CASEBOLT

SUBJECT: CHANGE OF ANALYSIS REQUIREMENTS FOR SAMPLE # NER 059

GARY,

WOULD YOU USE THE ACCOMPANYING ANALYSIS FORM FOR SAMPLE # NER 059 WHICH WAS DELIVERED TO THE COMBS' AIR TERMINAL MONDAY NIGHT AND RECEIVED BY YOUR REPRESENTATIVE ON TUESDAY MORNING.

THIS FORM IS TO REPLACE THE ONE SENT AS PART OF THE CHAIN OF CUSTODY AND ATTACHED TO THE ICE CHEST AS A PACKING LIST.

IF YOU HAVE ANY QUESTION PLEASE CALL ME AT (602) 643-7321

THANKS ALOT

LARRY CASEBOLT

ENERGY FUELS NUCLEAR, INC.

SAMPLE ANALYSIS INFORMATION

Perform those analysis marked with an X and circled

X	Ag Total (Dissolved) Suspended	X	pH
X	As Total (Dissolved) Suspended	X	Specific Cond. (micromhos per centimet
X	Ba Total (Dissolved) Suspended	X	TDS
	B Total Dissolved Suspended	X	TSS
X	Ca Total (Dissolved) Suspended	X	NO_3 as N
X	Cd Total (Dissolved) Suspended		NH_4 as N
X	Cr (Total) Dissolved Suspended X	X	PO_4
X	Cu Total (Dissolved) Suspended	X	SO_4
X	F Total (Dissolved) Suspended		SO_3
X	Fe Total (Dissolved) Suspended	X	SiO_2
X	Pb Total (Dissolved) Suspended		
X	Mg Total (Dissolved) Suspended		
	Mo Total Dissolved Suspended	X	Gross Alpha[a] (Total) (Dissolved) Suspende
X	Mn Total (Dissolved) Suspended	X	Gross Beta[a] (Total) (Dissolved) Suspende
X	Hg Total (Dissolved) Suspended		^{228}Ra[a] Total Dissolved Suspended
X	K Total (Dissolved) Suspended	X	^{226}Ra[a] (Total) (Dissolved) Suspended
X	Se Total (Dissolved) Suspended	X	Total U_{nat} Total Dissolved Suspended
X	Na Total (Dissolved) Suspended		^{210}Pb[a] Total Dissolved Suspended
X	Zn Total (Dissolved) Suspended		^{210}Po[a] Total Dissolved Suspended
X	Alkalinity (as carbonate)		^{234}U[a] Total Dissolved Suspended
X	Bicarbonate		^{235}U[a] Total Dissolved Suspended
X	Carbonate		^{238}U[a] Total Dissolved Suspended
X	Chloride		^{228}Th[a] Total Dissolved Suspended
		X	^{230}Th[a] (Total) (Dissolved) Suspended
			^{232}Th[a] Total Dissolved Suspended
Units are mg/l unless otherwise noted			^{40}K[a] Total Dissolved Suspended

[a]Units are pCi/l



DESCRIPTION OF

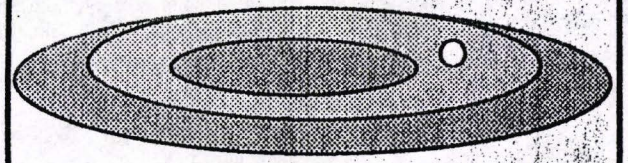
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INTRACID® RHODAMINE WT LIQUID

Water Tracing Dye



Non-hazardous bright fluorescent red dye for tracing water flow.

C & K

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1840 - 1990

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- Measuring waste water flow with bright, visible dye
- Circulation, dispersion and plume studies
- Flow measurements in sanitary sewers by dye dilution
- Flow measurement–general
- Fluorometry in water pollution control plants
- Time travel in streams

20% solution
Uses (25 lb → 5 gal) 16 oz/lb
(50 lb → 10 gal) 8 oz/lb
Extra (100 lb → 20 gal) 4 oz/lb
(250 lb → 50 gal) 1.6 oz/lb

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Industrial Products Division
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Freight Separate

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It is the only known non-hazardous underwater detective. It is non-toxic to aquatic life, and was found by a recent independent study to be a de minimus health risk to humans.

The success rate of our sleuth is phenomenal for other reasons, too.

Intracid Rhodamine WT Liquid...

- is a bright fluorescent red dye developed specifically for water tracing
- exhibits high resistance to absorption onto organic and inorganic sediment
- has high fluorescence at a special wavelength
- According to the U.S. Army Corps of Engineers, it poses no known environmental or heath hazards
- is detectable at 0.1 ppb
- is also used for estuarine flushing, subsurface water flow, water circulation patterns and other applications
- Recommended for city, county, state and Federal agencies as well as for industrial uses

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ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

REVIEW OF SHAFT AND RAISE CLOSURE PLAN AT THE HERMIT MINE OF ENERGY FUELS NUCLEAR, INC.

FEBRUARY, 1990

BEHRE DOLBEAR & COMPANY, INC.
1601 BLAKE STREET, SUITE 510
DENVER, COLORADO 80202
(303) 620-0020



PROJECT NO. D-0137

REVIEW OF SHAFT AND RAISE CLOSURE PLAN AT THE HERMIT MINE OF ENERGY FUELS NUCLEAR, INC.

INTRODUCTION

The Hermit Mine of Energy Fuels Nuclear, Inc. (EFNI), located in Section 17, T38N, R4W, Mohave County Arizona, is being closed because of depleted reserves. Part of Groundwater Quality Protection Permit No. G-0035-08 for the Hermit Mine reads as follows:

> "Upon cessation of mining operations, the operator shall implement the closure plan as referenced in the approved Plan of Operations. In the event that a geologic formation continues to produce water during the operational life of the mine, such formation shall be isolated from the lower geologic unit by the installation of a clay plug, a 40% clay/60% crushed shale plug or a bentonite plug in the main shaft, the air shaft and the monitoring well."

At the request of EFNI, a Behre Dolbear mining engineer visited the EFNI offices in Fredonia, Arizona on February 12, 1990 to review those portions of the EFNI mine closure plan relating to water containment and mine access. After a thorough review and discussions with members of the EFNI staff, a trip was made to the Hermit Mine to examine the locations where EFNI is proposing to place various plugs, a bulkhead, and fill material.

The person who made the examination was Richard Waissar, a mining engineer with 29 years of experience and a registered professional engineer in Colorado. Mr. Waissar is familiar with the geology and ground conditions in the area, having previously provided consulting services for parties other than EFNI at the Hack Canyon, Pigeon, and Kanab North Mines, which are in the same geologic environment.

PLAN DESCRIPTION

The EFNI closure plan is depicted in Figure 1. During the site visit it was observed that water was flowing from the Toroweap

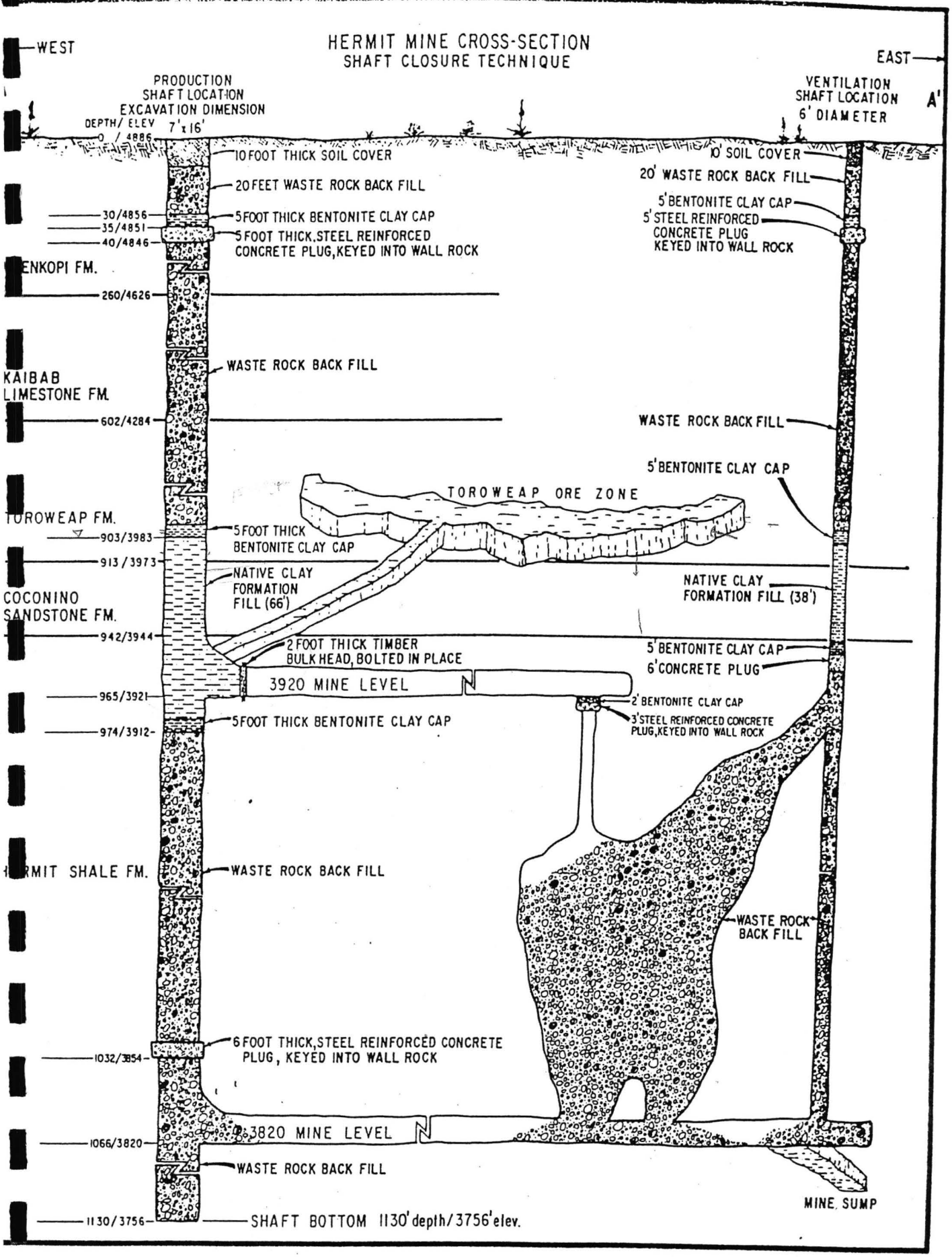

HERMIT MINE CROSS-SECTION
SHAFT CLOSURE TECHNIQUE
WEST
EAST
PRODUCTION SHAFT LOCATION EXCAVATION DIMENSION 7'x16'
DEPTH/ ELEV 0 / 4886
VENTILATION SHAFT LOCATION 6' DIAMETER
A'
10 FOOT THICK SOIL COVER
20 FEET WASTE ROCK BACK FILL
30/4856
35/4851
40/4846
5 FOOT THICK BENTONITE CLAY CAP
5 FOOT THICK, STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
ENKOPI FM.
260/4626
WASTE ROCK BACK FILL
KAIBAB LIMESTONE FM.
602/4284
10' SOIL COVER
20' WASTE ROCK BACK FILL
5' BENTONITE CLAY CAP
5' STEEL REINFORCED CONCRETE PLUG KEYED INTO WALL ROCK
WASTE ROCK BACK FILL
5' BENTONITE CLAY CAP
TOROWEAP ORE ZONE
TOROWEAP FM.
903/3983
5 FOOT THICK BENTONITE CLAY CAP
913/3973
NATIVE CLAY FORMATION FILL (66')
NATIVE CLAY FORMATION FILL (38')
COCONINO SANDSTONE FM.
942/3944
2 FOOT THICK TIMBER BULK HEAD, BOLTED IN PLACE
5' BENTONITE CLAY CAP
6' CONCRETE PLUG
3920 MINE LEVEL
965/3921
2' BENTONITE CLAY CAP
3' STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
974/3912
5 FOOT THICK BENTONITE CLAY CAP
RMIT SHALE FM.
WASTE ROCK BACK FILL
WASTE ROCK BACK FILL
1032/3854
6 FOOT THICK, STEEL REINFORCED CONCRETE PLUG, KEYED INTO WALL ROCK
3820 MINE LEVEL
1066/3820
WASTE ROCK BACK FILL
MINE SUMP
1130/3756
SHAFT BOTTOM 1130' depth/3756' elev.

FIGURE 1

ore zone down the incline and into the production shaft at a rate estimated to be 15-20 gallons per minute. The objective of the EFNI plan is to isolate this flow and flows from the Coconino Sandstone, which underlies the Toroweap formation, from lower geologic units. The next lower known aquifer is located in the Muav limestone which is separated from the Coconino sandstone by 1800 feet of other sedimentary rocks. Of particular interest is the Hermit shale, a relatively tight, impermeable shale approximately 30 feet below the Toroweap formation and about 1800 feet above the Muav limestone. Klinkenberg permeability tests performed on core samples of the Hermit shale taken at the mine showed an estimated vertical permeability below the detection level of the equipment, or at least 10^{-11} cm/sec. The bottom of the production shaft and the mine sump are in this shale. The various geologic structures are shown in Figure 2.

Referring once again to Figure 1, the sequence of the EFNI plan is as follows:

1. Drill and blast keyway excavation in production shaft at 3854 elevation.
2. Fill shaft with waste rock to 3854 elevation.
3. Pour 6-foot steel-reinforced concrete plug at key location.
4. After concrete plug cures sufficiently, fill shaft with waste rock backfill to 3912 elevation.
5. Place a 5-foot layer of bentonite at 3912 elevation.
6. Widen mouth of raise at end of 3920 level.
7. Pour 3-foot thick, steel-reinforced concrete plug beginning 5 feet below mouth of raise.
8. Place 2-foot thick layer of bentonite on top of concrete raise plug.
9. Construct 2-foot thick timber bulkhead in 3920 level to seal off shaft from level.

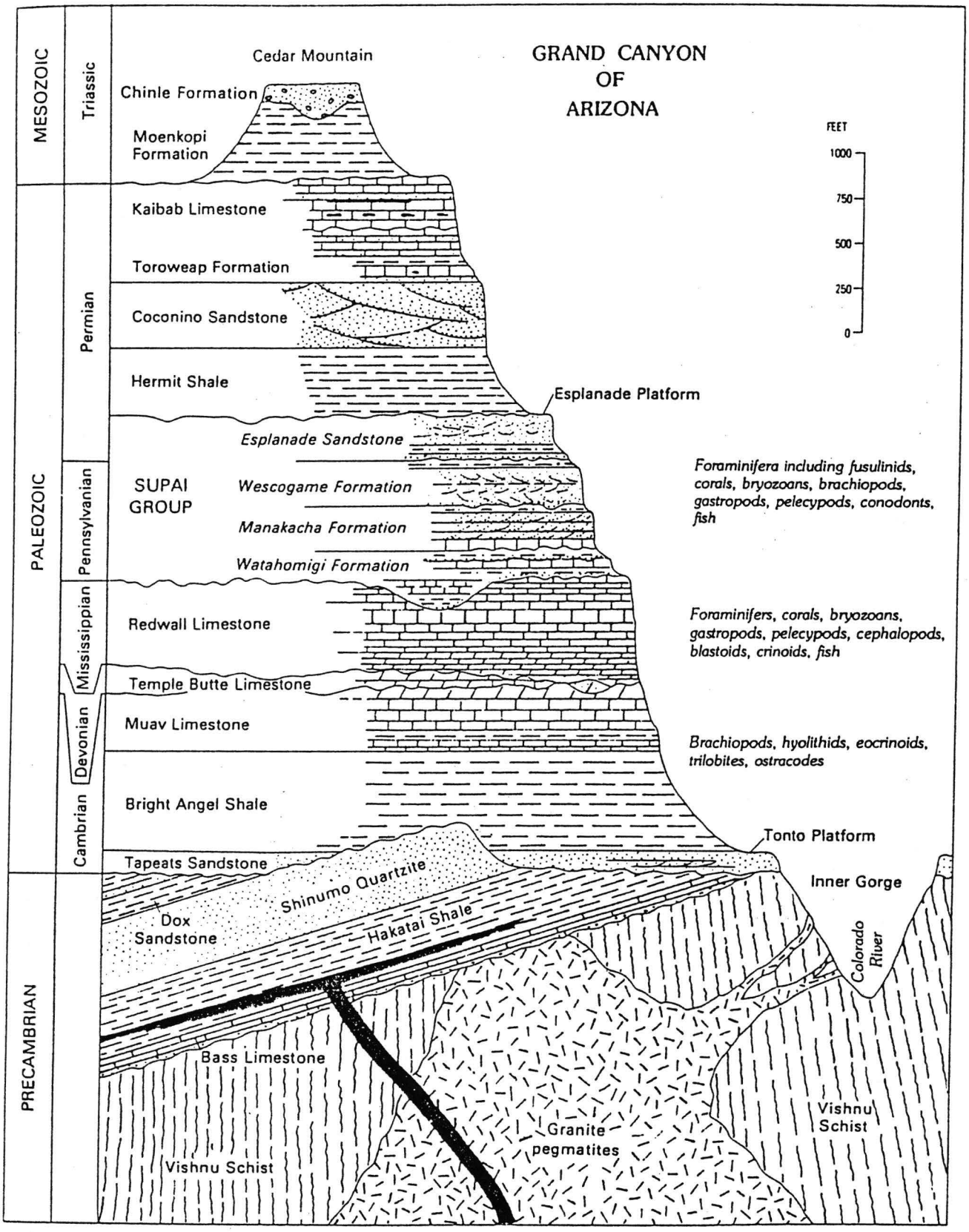

GRAND CANYON
OF
ARIZONA
MESOZOIC
PALEOZOIC
PRECAMBRIAN
Triassic
Permian
Pennsylvanian
Mississippian
Devonian
Cambrian
Cedar Mountain
Chinle Formation
Moenkopi Formation
Kaibab Limestone
Toroweap Formation
Coconino Sandstone
Hermit Shale
Esplanade Platform
Esplanade Sandstone
SUPAI GROUP
Wescogame Formation
Manakacha Formation
Watahomigi Formation
Redwall Limestone
Temple Butte Limestone
Muav Limestone
Bright Angel Shale
Tapeats Sandstone
Shinumo Quartzite
Dox Sandstone
Hakatai Shale
Bass Limestone
Vishnu Schist
Granite pegmatites
Vishnu Schist
Tonto Platform
Inner Gorge
Colorado River
FEET
1000
750
500
250
0
Foraminifera including fusulinids, corals, bryozoans, brachiopods, gastropods, pelecypods, conodonts, fish
Foraminifers, corals, bryozoans, gastropods, pelecypods, cephalopods, blastoids, crinoids, fish
Brachiopods, hyolithids, eocrinoids, trilobites, ostracodes

FIGURE 2

10. Backfill shaft and portion of shaft station at 3920 level with Moenkopi derived soil obtained from surface excavations (called "native clay formation fill" in Figure 1).
11. Place 5-foot thick bentonite clay cap on top of Moenkopi material at 3983 elevation.
12. Fill shaft to 4846 elevation with waste rock.
13. Drill and blast 5-foot keyway at 4846 elevation.
14. Pour 5-foot thick, steel-reinforced concrete plug at 4846 elevation. NOTE: The purpose of this plug is to prevent surface subsidence and to assist in the prevention of surface water inflows.
15. Place 5-foot thick bentonite plug on top of concrete plug.
16. Fill shaft to within 10 feet of surface with waste rock.
17. Fill remaining portion of production shaft with surface soil.
18. Fill ventilation shaft and stope with waste rock to a point approximately 11 feet below the Coconino sandstone.
19. Using a concrete bucket suspended from a cable, pour a 6-foot thick concrete plug on top of the rock fill. NOTE: The ventilation shaft was bored by machine. The walls, although relatively smooth, are typically sufficiently grooved by the reamer employed in making the opening to promote a good bonding action between the shaft walls and the concrete.
20. Place 5 feet of bentonite on top of concrete plug.
21. Fill shaft with 38 feet of "native clay formation" to seal off Coconino sandstone.
22. Place 5 feet of bentonite on top of native clay.
23. Fill ventilation shaft with waste rock to within 35 feet of surface.
24. Drill and blast 10-foot diameter keyway at 4846 elevation.

25. Pour 5-foot, steel-reinforced concrete plug.
26. Place 5 feet of bentonite on top of concrete.
27. Fill shaft with waste rock to within 10 feet of surface.
28. Fill remaining portion of shaft with surface soil.

The shaft plug at the 3854 elevation will be poured on a wooden platform supported by steel beams which now form part of an existing shaft set. The raise plug will be poured on timbered lagging. All other concrete plugs will be poured directly on rock backfill. Sketches prepared by an EFNI engineer showing rebar size and spacing, concrete specifications, and plug dimensions are attached to this report.

While at the site, a visual examination was made of the Moenkopi derived soil to be placed in the shafts. The material appeared to have high clay and shale contents, which should make it suitable for its intended purpose. Laboratory tests on samples of the material to determine its suitability are currently being performed by the firm of Chen Northern, Inc. in Denver. The test results, however, were not yet available at the time this report was prepared.

CONCLUSIONS

It is the opinion of Behre Dolbear that EFNI closure plan for the Hermit Mine meets or exceeds the requirements of Groundwater Quality Protection Permit No. G-0035-08. Migration of any mine inflow to the Muav limestone is essentially precluded by the fact that the two shafts bottom in the tight Hermit shale which should preclude any possible intermingling of aquifer waters. Further protection is afforded by the design of the concrete plugs and bentonite caps which are more than adequate to insure compliance with the permit requirements. Finally, the apparent clay content of the Moenkopi derived soil should insure the isolation of the Toroweap-Coconino formations from the lower geologic units.

SHAFT PLUG - 3854 LEVEL

SCALE 1" = 50'

SHAFT SIZE : 16' X 7'

KEYWAY SIZE: 20' X 11'

REBAR MATS - #6 BAR

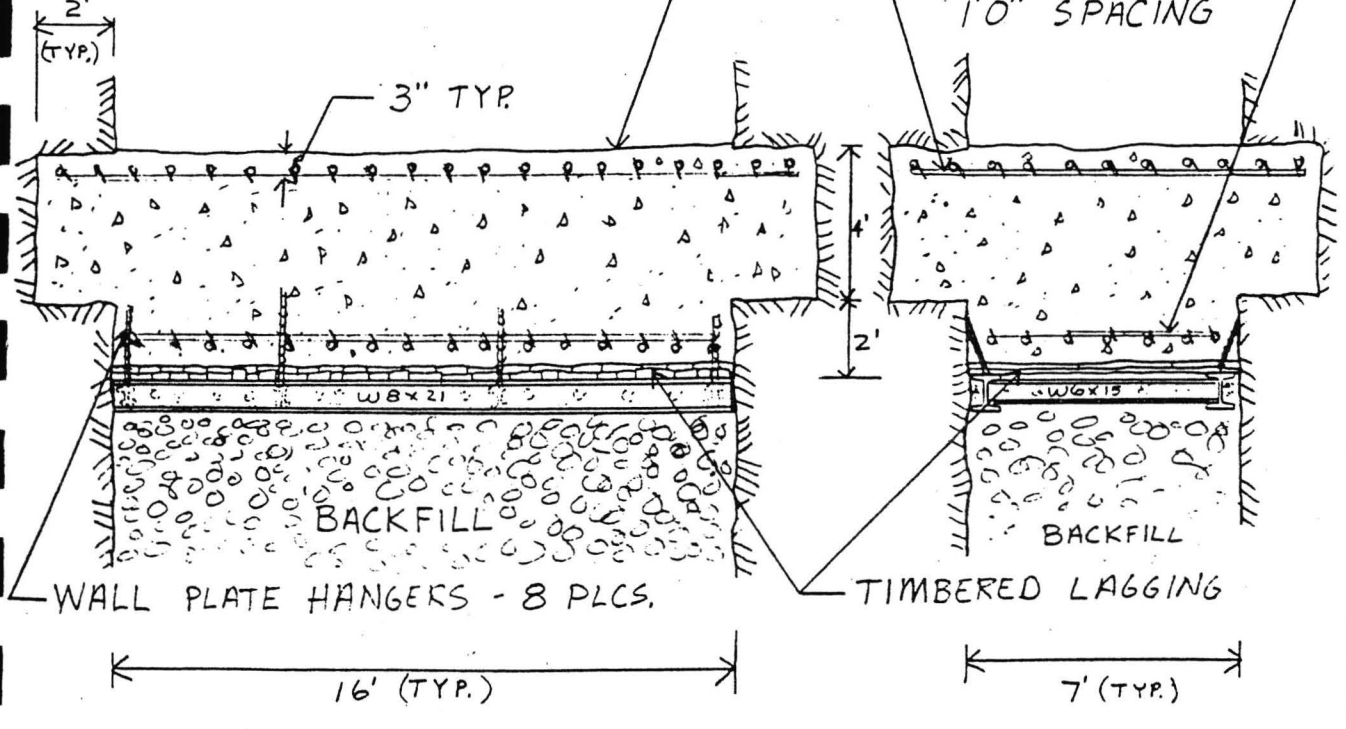
5½ BAG CONCRETE - 2800 PSI

6' THICK - 40.9 YDS.

TOP 19' X 10'

BOTTOM 15' X 6'

1'0" SPACING



SHAFT PLUG 4846 LEVEL

SHAFT SIZE : 16' X 7'

SCALE 1" = 50'

KEYWAY SIZE : 20' X 11'

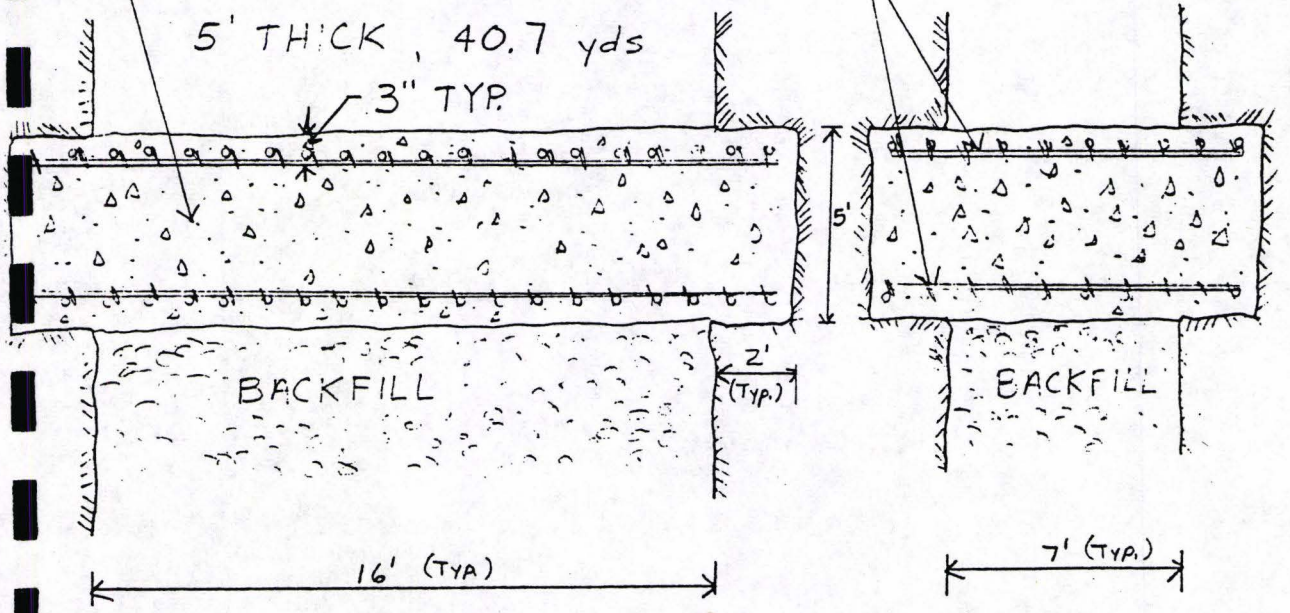
REBAR MATS - #6

19' X 10' - 1' SPACING

5½ BAG CONCRETE - 2800 PSI

5' THICK , 40.7 yds

3" TYP.

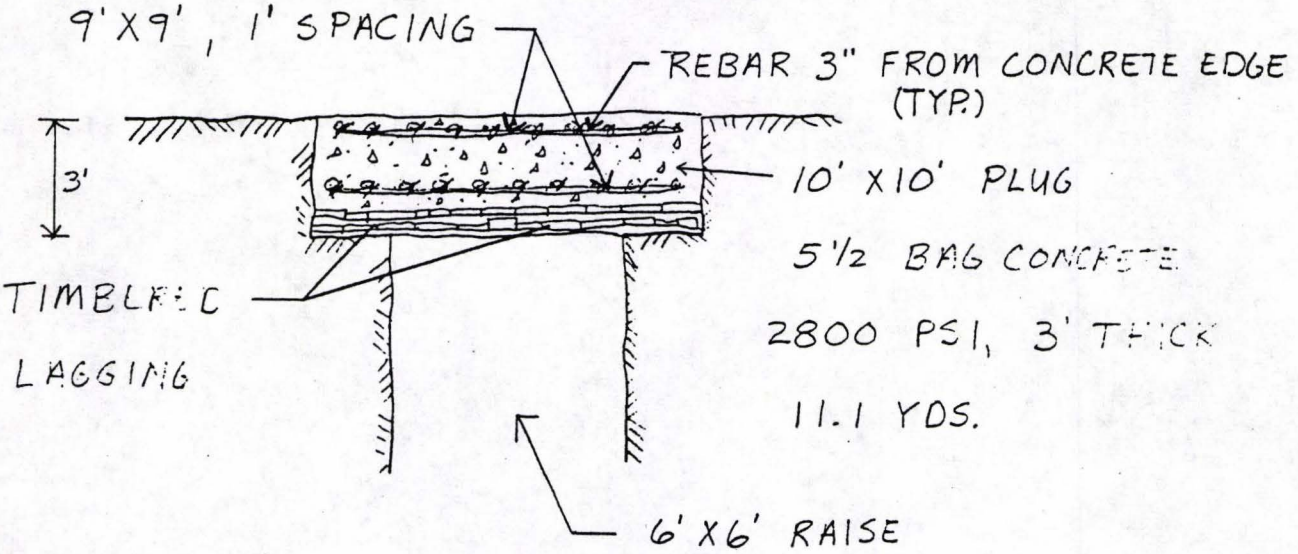


RAISE PLUG 3920 LEVEL

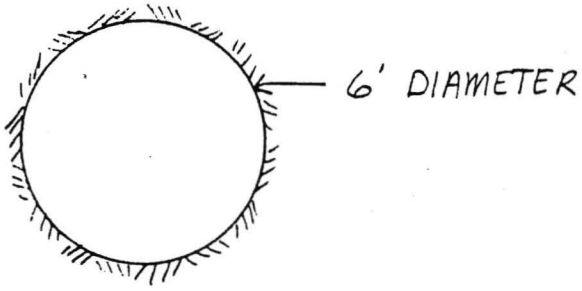
6' X 6' RAISE

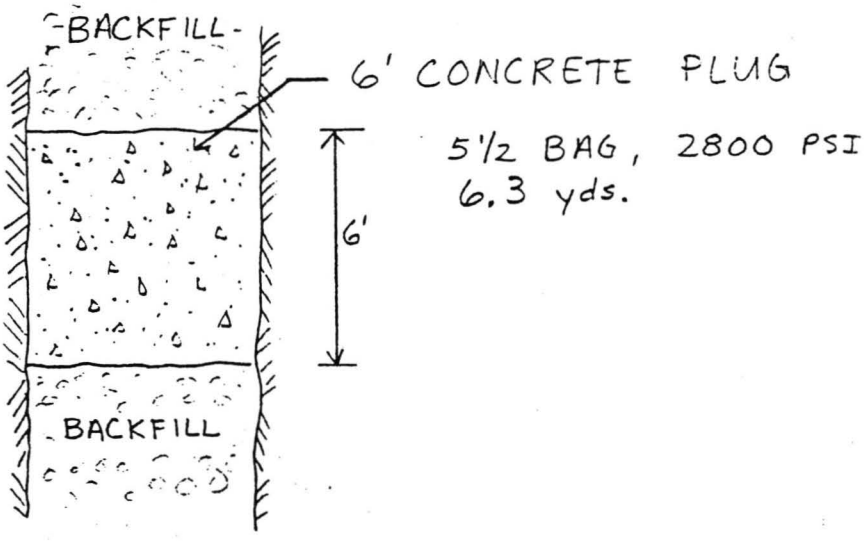
SCALE 1" = 50'

REBAR MAT, #6, TOP & BOTTOM,
9'X9', 1' SPACING

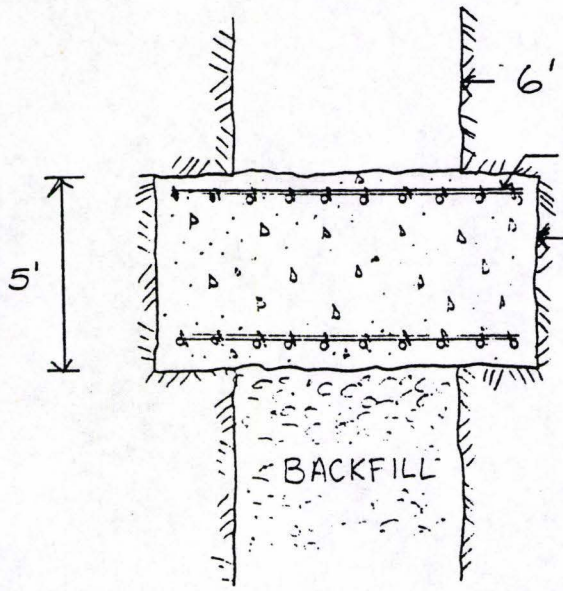


VENTILATION SHAFT PLUG - 3930 LEVEL



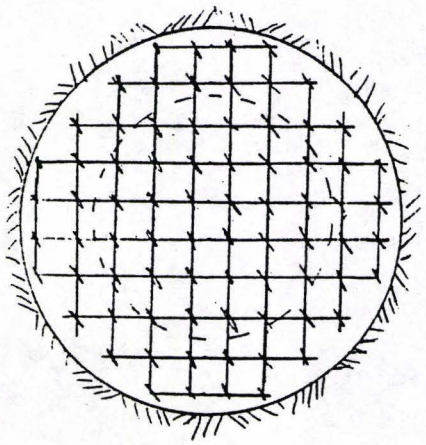


VENTILATION SHAFT PLUG, 4846 LEVEL



5' CONCRETE PLUG, 2800 PSI

5½ BAG, 14.5 YDS.



REBAR MAT, TOP AND BOTTOM

1' BAR SPACING, #6 REBAR

HERMIT MINE
GROUNDWATER MONITORING REPORT
MINING PHASE

SUBMITTED TO
ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

BY
ENERGY FUELS NUCLEAR, INC.

FEBRUARY 12, 1990



Hermit Mine
Groundwater Monitoring Report
Mining Phase

Introduction

The Hermit Mine operates under the terms and conditions of the Hermit Mine Groundwater Protection Permit #G-0035-08. Section II.B.1.b. of the Permit outlines groundwater monitoring actions which must be taken during the mining phase of operations. This report presents and summarizes data collected during the mining phase.

Table I lists the dates, types and purposes of samples included within this report.

Discharge Monitoring

The Hermit Mine Facility was designed as a non-discharging facility. The surface facilities associated with the mine have been designed so that all surface water drains to lined surface impoundments. Mine water produced during mining operations has been pumped to the lined surface impoundments for evaporation or for use within the mine operations area for dust suppression.

A septic system with an associated leach field has been constructed at the Hermit Mine for disposal of sewage and wash water only. In compliance with provisions of the Groundwater Protection Permit, septic system effluent is sampled on an annual basis and analyzed for the parameters listed in II.B.2.b.

An annual septic system sample was obtained by bailing from the septic tank through the clean-out port. Analytical results are presented as Attachment I to this report.

Other possible so ces of apparent high con itrations of some constituents in groundwater are natural causes related to the season, variations in precipitation amounts or other unidentified temporally or spatially related factors. A total of only eight samples have been taken to date, spanning a time period of less than two years. This is an inadequate number of samples and too short a time frame to detect naturally occurring changes in groundwater quality.

Mine Inflow Monitoring

Table III illustrates mine inflow volumes as determined by a totaling flow meter measuring discharge from the mine sump to the surface evaporation pond. Water was produced almost entirely from the area just above the Coconino sandstone-Toroweap limestone contact. The location for the monitor point for water quality inflow is located 908 feet below the shaft collar elevation as shown on Plate 1 of the Premining Water Quality Report.

Water quality samples and analysis have been obtained from both the monitor point in the shaft and the mine sump. Samples HER 045 and 050 are shaft inflow monitoring samples and are included in Attachment III, Shaft Water Monitoring Samples Analysis. Samples have been analyzed for the parameters listed in II.B.2.b. Samples HER 043 and 049 are samples taken from water originating in the mine sump and analyzed for the parameters listed in II.B.2.b. Water quality analysis for these analysis are included in Attachment 4.

Contingency Requirements

Pursuant to provisions of Section II.C, Contingency Requirements, in the Groundwater Protection Permit, EFN hereby notifies the ADEQ of an exceedance of alert levels in the HER 044 monitor well sample (taken 06/29/89) for indicator elements iron, manganese and uranium. HER 051, taken 10-19-89, is the confirmation sample which indicated a continued exceedance of maximum groundwater

AL vs MCLs?

limitations for manganese and uranium, but not iron. Additionally, the confirmation sample showed exceedances in magnesium, potassium, sodium, gross beta and electrical conductivity.

There is no reason to believe that groundwater within the Redwall-Muav aquifer has been impacted by mining operations in anyway. Detailed evaluation of the site specific hydrogeology of the area was performed by Canonie Environmental and presented to the ADEQ in the report, "Potential Impacts of Mining on Groundwater Resources, October, 1987". Other researchers, such as Huntoon (1974) and (1982), Levings (1979) and Metzger (1961) have studied and described the hydrogeology of the Grand Canyon area as well. These investigations all note the very low transmissivities of the Hermit Shale to groundwater flow, except where major faults allow downward vertical flow. It is also well documented that the geologic profile is unsaturated to the Redwall-Mauv limestones, except for localized perch zones, such as the Coconino sandstone-Hermit shale interface at the Hermit Mine site. Based upon the best available evidence from numerous sources, the likelihood of groundwater communication between the mine workings and Redwall-Mauv aquifer is remote.

In the unlikely event that communication between the mine workings and the Redwall-Mauv aquifer were taking place, impacts to the Redwall-Mauv aquifer would be negligible. Although the most recent sample (HER 051) indicates seven parameters with concentrations in excess of maximum groundwater limits, these limits, in absolute terms, are very low. Maximum groundwater limits are based on the premining water quality average plus two standard deviations of the sampling mean. Thus, maximum groundwater limits are based on background concentrations, and are not health based standards.

Mn, U, Mg, K, Na, Gross β, EC

Three of the seven parameters (Mn, SO_4 and TDS) have a federal secondary drinking water standard associated with them. In all cases, the premining mean (baseline) of sample results exceeds the secondary standard. Secondary drinking water standards apply principally to aesthetics of drinking water and are not health based, except at much high concentrations.

Three parameters (U, Na, Mg) have no primary or secondary drinking water standard associated with them. Uranium concentrations are reflected in gross alpha radiation determinations. Since the premining baseline already exceeds the primary drinking water standard and gross alpha radiation determinations fall within maximum groundwater limitations, increased uranium concentrations are not considered an immediate concern.

Gross beta might exceed the 4 MREM/year primary drinking water standard, depending on the proportions of various radionuclides contributing to the gross beta measurement.

Proposed Actions and Summary

Energy Fuels Nuclear has investigated the site hydrogeology at the Hermit Mine and on the basis of all existing available information, believes that apparent exceedances of maximum groundwater limits are attributable to causes other than contamination as a result of mining activities. Possible causes for the apparent exceedances have been listed and briefly discussed in the Water Quality Results section of this report.

Energy Fuels Nuclear's proposed approach to determining the cause(s) of the apparent exceedances is to augment the existing monitoring program in an attempt to confirm or eliminate sources of error. The following actions are proposed:

- Accelerate sampling to a monthly basis for the monitoring well and perform analysis for the full series of parameters listed in II.B.2.b in order.

- Evaluate the feasibility of using radiochemical or colored tracers carbon dating of water or use of stable isotope analysis to determine the relative age and/or source of groundwater in the monitoring well. The feasibility of using these techniques will be discussed in the next quarterly monitoring report.

- Initiate additional quality control into the sampling and analytical processes by obtaining split samples and submitting samples to two different laboratories for comparison.

- Analyze groundwater samples for both total and dissolved radionuclides to determine the effects of increased suspended matter in groundwater samples.

- Analyze groundwater samples for all major radionuclides within the U-238 decay chain to determine specific sources of alpha contamination.

These steps are proposed for a three month period. After receiving this information, it will be compiled, evaluated and presented to ADEQ for review and discussion.

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Billingsley, George H., Stanley S. Beus. The Surprise Canyon formation-an Upper Mississippian and Lower Pennsylvanian rock unit in the Grand Canyon, Arizona. U.S. Geological Survey Bulletin 1605-A, 1985, p A27-A33.

Canonie Environmental Services Corp. Potential impacts of mining on groundwater resource and for the Hermit Mine. Report to Energy Fuels Nuclear, Inc., November 6, 1987.

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ATTACHMENT 1

SEPTIC ANNUAL MONITORING RESULTS

Septic water would be drawing from R/M aquifer

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SPARKS, NEVADA 89431
PHONE: (702) 358-1158

30-Nov-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

Sample Type: Water

Sample Id	Alkalinity as CaCO3 mg/l	As Total mg/l	Ba Total mg/l	HCO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l
HER 1S-4S	479	0.007	0.02	479	<0.005	475	859

Sample Id	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HER 1S-4S	<0.01	5760	0.04	1.20	0.45	<0.02	147

Sample Id	Mn Total mg/l	Hg Total mg/l	NO3 as N mg/l	PO4 as P Total mg/l	K Total mg/l	Se Total mg/l	SiO2 mg/l
HER 1S-4S	0.29	<0.0002	<0.1	5.8	42.5	0.018	11.1

Sample Id	Ag Total mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HER 1S-4S	<0.01	841	4720	2100	0.572	195	±40

Sample Id	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HER 1S-4S	110	±20	29	±3	5.4	±1.4	0.039

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Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

Abbreviations:

Analyses:

As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids
SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

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Authority:
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Purchase order :

Job: 891246E Status: Final

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 10/2/89 By: T.Moncrief Via: UPS

Sample Container Type: large cube
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Swanson	10/18
As	1	206.2	0.001 mg/l	1	Gilleland	10/18
Ba	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Cd	1	200.7	0.005 mg/l	1	Hidalgo	10/25
Ca	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Cl	1	325.2	1 mg/l	3	Hobbs	10/13
Cr	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/13
Cu	1	200.7	0.01 mg/l	1	Hidalgo	10/25
F	1	340.2	0.05 mg/l	3	Acree	10/23
Fe	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Pb	1	200.7	0.02 mg/l	1	Hidalgo	10/25
Mg	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Mn	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Hg	1	245.1	0.0002 mg/l	1	Swanson	10/13
NO3	1	353.1	0.1 mg/l	2	Hobbs	10/9
PO4	1	365.1	0.1 mg/l	3	Hobbs	10/11
K	1	200.7	0.5 mg/l	1	Hidalgo	10/25
Se	1	270.2	0.001 mg/l	1	Gilleland	10/19
SiO2	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Ag	1	200.7	0.01 mg/l	1	Hidalgo	10/25
Na	1	200.7	0.01 mg/l	1	Hidalgo	10/25

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PHONE: (702) 358-1158

30-Nov-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891246E Status: Final

TDS	1	160.1	10	mg/l	3	Acree	10/16
SO4	1	375.3	5	mg/l	3	Acree	10/16
Zn	1	200.7	0.005	mg/l	1	Hidalgo	10/25
Gr.Alpha	4	---	1.0	pCi/l	3	Seidel	11/2-11/17
Gr.Beta	4	---	2.0	pCi/l	3	Seidel	11/2-11/17
Ra-226	4,7,14	---	0.2	pCi/l	3	Howard	10/31-11/2
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/7-11/10
U	4,9,10,14	---	0.3	µg/l	3	Krizman	10/18-11/20

BARRINGER LABORATORIES INC.

15000 W 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

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PHONE: (702) 358-1158

30-Nov-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HER 1S-4S	Alkalinity	479.0	482.6	0.6
HER 1S-4S	As	.007	.007	0.0
HER 1S-4S	Ba	.02	.02	0.0
HER 1S-4S	Cd	<.005	<.005	0.0
HER 1S-4S	Ca	475	476	0.2
HER 1S-4S	Cl	852	865	1.5
HER 1S-4S	Cr	<.01	<.01	0.0
HER 1S-4S	Sp.Cond.	5761.1	5761.1	0.0
HER 1S-4S	Cu	.04	.04	0.0
HER 1S-4S	Fe	.45	.45	0.0
HER 1S-4S	Pb	<.02	<.02	0.0
HER 1S-4S	Mg	147	147	0.0
HER 1S-4S	Mn	.29	.29	0.0
HER 1S-4S	Hg	<.0002	<.0002	0.0
HER 1S-4S	NO3	<.1	<.1	0.0
HER 1S-4S	PO4	5.77	5.77	0.0
HER 1S-4S	K	42.5	42.2	0.7
HER 1S-4S	Se	.018	.016	12
HER 1S-4S	SiO2	11.1	11.1	0.0
HER 1S-4S	Ag	<.01	<.01	0.0
HER 1S-4S	Na	841	842	0.1
HER 1S-4S	Zn	.572	.579	1.2
HER 1S-4S	Gr.Alpha	150 ± 30	87 ± 16	23.1
HER 1S-4S	Gr.Beta	240 ± 50	130 ± 20	19.8
HER 1S-4S	U	.041	.036	6.5

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30-Nov-89

Larry Casebolt
ENERGY FUELS NUCLEAR
P.O. Box 36
Fredonia, AZ 86022

Authority:
Project :

Purchase order :

Job: 891246E

Status: Final

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
As	.097	.100	.080 - .118	3	---
Ba	.97	.97	.89 - 1.09	0.0	96
Cd	.209	.200	.180 - .220	4.5	104
Ca	254	250	225 - 275	1.6	104
Cl	25.3	26.05	24.1 - 27.7	2.9	---
Cr	.206	.200	.180 - .220	3.0	100
Cu	.200	.200	.180 - .220	0.0	99
F	.52	.50	.45 - .55	3.9	103
Fe	.216	.200	.180 - .220	8.0	120
Pb	.206	.200	.180 .220	3.0	93
Mg	242	250	225 - 275	3.2	108
Mn	.208	.200	.180 - .220	4.0	104
Hg	.008	.008	.007 - .009	0.0	100
NO3	2.06	1.98	1.78 - 2.18	4.0	---
PO4	.47	.50	.46 - .54	6.2	---
K	10.0	10.0	9.0 - 11.0	0.0	85
Se	.009	.009	.006 - .012	0.0	---
SiO2	.94	1.00	.90 - .110	6.0	---
Ag	1.04	.99	.89 - 1.09	5.0	101
Na	249	250	225 - 275	0.4	101
TDS	1408	1479	1331 - 1627	4.9	---
SO4	1062	1000	900 - 1100	6.0	---
Zn	.207	.200	.180 - .220	3.5	118
Gr.Alpha	193 ± 4	198	178 - 218	2.5	---
Gr.Beta	164 ± 2	179	161 - 197	8.4	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	102 ± 3	99	94 - 104	3.0	---
U	35	34	32 - 36	2.9	---

Approved by: _____

ATTACHMENT 2

SECOND AND THIRD QUARTER, 1989
WELL MONITORING RESULTS
AND
SECOND QUARTER, 1989 CONFIRMATION SAMPLE RESULTS

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1466 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1188

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: L. Casebolt

Client No. Log No. 633 Client PO No.

Sample Type: water

Date Collected: 6/29/89 Date Received: 7/7/89 Date Reported: 8/3/89

RESULTS OF ANALYSIS

Sample Identification	As Total mg/l	Ba Total mg/l	Cd Total mg/l	Cu Total mg/l	Fe Total mg/l	Pb Total mg/l	Mn Total mg/l
HER044	.004	.02	.006	.02	12.0	<.02	.23

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	Se Total mg/l	Ag Total mg/l	Zn Total mg/l
HER044	<.0002	.3	.020	<.01	.077

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER044	28 ± 21	40 ± 11	0.0035

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 633

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 7/7/89 By: Gina Reichert Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Arsenic	1	206.2	1 ug/l	1	G. Gilliland	7/19/89
Selenium	1	270.2	1 ug/l	1	G. Gilleland	7/19/89
Nitrate	1	353.1	0.1 mg/l	2	D. Hobbs	7/20/89
Mercury	1	245.1	0.2 ug/l	1	M. Swanson	7/20/89
Barium	1	200.7	10 ug/l	1	D. Hidalgo	7/20/89
Cadmium	1	200.7	5 ug/l	1	D. Hidalgo	7/20/89
Copper	1	200.7	10 ug/l	1	D. Hidlago	7/20/89
Iron	1	200.7	10 ug/l	1	D. Hidalgo	7/20/89
Lead	1	200.7	2 ug/l	1	D. Hidalgo	7/20/89
Manganese	1	200.7	1 ug/l	1	D. Hidalgo	7/20/89
Silver	1	200.7	10 ug/l	1	D. Hidalgo	7/20/89
Zinc	1	200.7	5 ug/l	1	D. Hidalgo	7/20/89
Alpha-Beta	4		1.0,2.0 pCi/l	3	M. Kidwell	7/19-7/31/89
Uranium	4,14		0.3 ug/l	3	B. Tonning	7/26-7/29/89

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HERO44	Arsenic	.004	.005	20.0%
HERO44	Selenium	.019	.019	0.0%
HERO44	Nitrate	.3	.3	0.0%
HERO44	Mercury	<.0002	<.0002	0.0%
HERO44	Barium	.02	.02	0.0%

Approved by _____

Barringer Laboratories
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Golden, CO 80401
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Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 633

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER044	Cadmium	.006	<.005	---
HER044	Copper	.02	.02	0.0%
HER044	Iron	12.0	11.9	0.8%
HER044	Lead	<.02	<.02	0.0%
HER044	Manganese	.23	.23	0.0%
HER044	Silver	<.01	<.01	0.0%
HER044	Zinc	.077	.074	3.9%
HER044	Gross Alpha	13 ± 19	42 ± 23	54.0%
HER044	Gross Beta	39 ± 11	42 ± 11	3.7%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Target Range	Relative Deviation From Known	Spike % Recovery
Arsenic	.062	.062	.048 - .073	0.0%	100
Selenium	.009	.009	.006 - .012	0.0%	---
Nitrate	2.08	1.98	1.78 - 2.18	4.9%	101
Mercury	.005	.005	.004 - .006	0.0%	100
Barium	.96	.97	.87 - 1.07	1.0%	97
Cadmium	.212	.200	.180 - .220	6.0%	98
Copper	.205	.200	.180 - .220	2.5%	104
Iron	.219	.200	.180 - .220	9.5%	---
Lead	.181	.200	.180 - .220	9.5%	97
Manganese	.207	.200	.180 - .220	3.5%	106
Silver	.90	.99	.89 - 1.09	9.0%	90
Zinc	.203	.200	.180 - .220	1.5%	115
Gross Alpha	216 ± 4	198	178 - 218	9.1%	---
Gross Beta	175 ± 2	179	161 - 197	2.2%	---
Uranium	33	34	32 - 36	2.9%	---

Approved by Barbara Cogg

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
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PHONE: (702) 358-1158

18-Dec-89

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	NH4 as N mg/l	As Total mg/l	Ba Total mg/l	HCO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l
HERO 48	150	0.3	0.008	0.02	150	<0.005	542
HERO 49	116	14.5	0.530	0.01	116	<0.005	521
HERO 50	203	0.3	0.006	0.01	203	<0.005	510

Sample	Cl Total mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HERO 48	40	<0.01	3470	<0.01	1.28	11.60	<0.02	186
HERO 49	38	<0.01	3820	0.02	1.35	0.25	0.03	187
HERO 50	38	<0.01	3590	<0.01	0.98	1.11	<0.02	162

Sample	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Total mg/l	Se Total mg/l
HERO 48	0.49	<0.0002	0.02	<0.1	6.92	<0.1	24.2	0.009
HERO 49	0.08	<0.0002	6.45	31.4	6.69	<0.1	36.1	0.017
HERO 50	0.02	<0.0002	0.01	<0.1	7.05	<0.1	36.4	0.011

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18-Dec-89

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	SiO2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HERO 48	11.5	<0.01	76.0	3440	2280	<0.005	19	±18
HERO 49	11.2	0.02	97.8	3530	2300	0.156	29800	±300
HERO 50	9.9	<0.01	144.0	3320	2190	0.009	1400	±100

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HERO 48	41	±10	3.3	±0.6	0.2	±0.5	0.0041
HERO 49	10100	±100	60	±3	710	±20	18.4
HERO 50	150	±10	350	±10	1.7	±0.9	0.025

BARRINGER LABORATORIES INC.

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ENERGY FUELS CORPORATION
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Suite 2500
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Job: 891214E

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AMENDED REPORT

Abbreviations:

Analyses:

NH4 as N	: Ammonia
As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
Mo	: Molybdenum
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids

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SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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Suite 2500
Denver, CO 80202

Authority:
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Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 9/27/89 By: T.Moncreif Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH/Zn Acetate
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Swanson	10/5
NH4	1	350.1	0.1 mg/l	2	Hobbs	10/5
As	1	206.2	0.001 mg/l	1	Gilleland	10/4
Ba	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cd	1	200.7	0.005 mg/l	1	Hidalgo	10/20
Ca	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cl	1	325.2	1 mg/l	3	Hobbs	10/4
Cr	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/5
Cu	1	200.7	0.01 mg/l	1	Hidalgo	10/20
F	1	340.2	0.05 mg/l	3	Acree	10/12
Fe	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Pb	1	200.7	0.02 mg/l	1	Hidalgo	10/20
Mg	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Mn	1	200.7	0.01 mg/l	1	Hidalgo	10/20

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Job: 891214E Status: Final

AMENDED REPORT

Hg	1	245.1	0.0002	mg/l	1	Swanson	10/2
Mo	1	200.7	0.01	mg/l	1	Hidalgo	10/20
NO3	1	353.1	0.1	mg/l	2	Hobbs	10/3
pH	1	210.1	0.01	unit	3	Acree	10/2
PO4	1	365.1	0.1	mg/l	3	Hobbs	10/11
K	1	200.7	0.5	mg/l	1	Hidalgo	10/20
Se	1	270.2	0.001	mg/l	1	Gilleland	10/4
SiO2	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Ag	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Na	1	200.7	0.01	mg/l	1	Hidalgo	10/20
TDS	1	160.1	10	mg/l	3	Acree	10/3
SO4	1	375.3	5	mg/l	3	Acree	10/3
Zn	1	200.7	0.005	mg/l	1	Hidalgo	10/20
Gr.Alpha	4	900.0	1.0	pCi/l	3	Seidel	11/16-12/1
Gr.Beta	4	900.0	2.0	pCi/l	3	Seidel	11/16-12/1
Ra-226	4,7,14	903.0,903.1	0.2	pCi/l	3	Howard	10/31-11/2
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/6-11/10
U	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Tonning	10/17-11/20
U(RR)	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Krizman,Tonning	12/11-12/18

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18-Dec-89

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ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HERO 50	Alkalinity	203	203	0.0
HERO 50	NH4	.34	.34	0.0
HERO 50	As	.006	.006	0.0
HERO 50	Ba	.01	.01	0.0
HERO 50	Cd	<.005	<.005	0.0
HERO 50	Ca	510	511	0.2
HERO 50	Cl	38.2	38.2	0.0
HERO 50	Cr	.01	<.01	---
HERO 50	Sp.Cond.	3590	3590	0.0
HERO 50	Cu	<.01	<.01	0.0
HERO 50	Fe	1.11	1.11	0.0
HERO 50	Pb	<.02	<.02	0.0
HERO 50	Mg	162	161	0.6
HERO 50	Hg	<.0002	<.0002	0.0
HERO 50	Mo	.01	<.01	---
HERO 50	NO3	<.1	<.1	0.0
HERO 50	PO4	<.1	<.1	0.0
HERO 50	K	36.4	36.0	1.0
HERO 50	Se	.010	.011	9
HERO 50	SiO2	9.9	9.9	0.0
HERO 50	Ag	<.01	<.01	0.0
HERO 50	Na	144	143	0.7
HERO 50	Zn	.009	.008	---
HERO 50	U	.025	.025	0.0
HERO 48	U(RR)	.0044	.0039	6.0

BARRINGER LABORATORIES INC.

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18-Dec-89

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
NH4	2.05	1.98	1.78 - 2.18	3.5	108
As	.104	.100	.080 - .118	4	92
Ba	.96	.97	.87 - 1.07	1	94
Cd	.189	.200	.180 - .220	5.5	77
Ca	247	250	225 - 275	1.2	---
Cl	26.16	26.05	24.1 - 27.7	0.4	---
Cr	.201	.200	.180 - .220	0.5	97
Cu	.199	.200	.180 - .220	0.5	93
F	.49	.50	.45 - .55	2.0	116
Fe	.198	.200	.180 - .220	1.0	109
Pb	.204	.200	.180 - .220	2.0	79
Mg	255	250	225 - 275	2.0	---
Mn	.198	.200	.180 - .220	1.0	91
Hg	.005	.005	.004 - .006	0.0	100
Mo	.198	.200	.180 - .220	1.0	91
NO3	2.04	1.98	1.78 - 2.18	3	---
PO4	.49	.50	.46 - .54	2.0	---
K	9.8	10.0	9.0 - 11.0	2.0	86
Se	.022	.025	.017 - .028	13	---
SiO2	1.03	1.07	.96 - 1.18	4.0	114
Ag	.92	.99	.89 - 1.09	7.0	88
Na	256	250	225 - 275	2.4	---
TDS	1430	1479	1331 - 1627	3.4	---
SO4	1051	1000	900 - 1100	5	---
Zn	.189	.200	.180 - .220	5.5	94
Gr.Alpha	167 ± 4	198	178 - 218	15.7	---
Gr.Beta	157 ± 2	179	161 - 197	12.3	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	97 ± 3	99	94 - 104	2.0	---
U	33	34	32 - 36	2.9	---
U(RR)	32	34	32 - 36	5.9	---

Approved by: _____

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1485 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

8-Dec-89

Attn: Al Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Page: 1
Copy: 2 of 3
Set : 1

Authority:
Project :

Purchase order :

Job: 891358E Status: Final

Sample Type: Water

Sample	HCO3 as CaCO3 mg/l	As Total mg/l	Ba Total mg/l	CO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l
HER 051	150	0.022	0.01	<1	<0.005	547	39	0.01

Sample	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l
HER 051	3600	<0.01	1.43	4.71	<0.02	201	0.39

Sample	Hg Total mg/l	NO3 as N mg/l	PO4 as P Total mg/l	K Total mg/l	Se Total mg/l	SiO2 mg/l	Ag Total mg/l	Na Total mg/l
HER 051	<0.0002	<0.1	<0.1	31.6	0.023	9.8	<0.01	102

Sample	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*	Gross Beta Total pCi/l	Error 2σ*
HER 051	3220	2280	0.013	78	±21	54	±16

Sample	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HER 051	0.8	±0.3	0.0	±0.4	0.0064

ATTACHMENT 3

SHAFT WATER MONITORING RESULTS

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
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PHONE: (303) 277 1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE (702) 358-1158

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN:

Client No. Log No. 584 Client PO No.

Sample Type: water

Date Collected: 6/27/89 Date Received: 7/5/89 Date Reported: 8/23/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HER045	206	206	<1	.008	.05

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl Total mg/l	Conductance umho/cm	Cu Total mg/l
HER045	<.005	538	35.5	3020	.03

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l
HER045	1.00	1.17	<.02	150	.06	<.0002

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by

Barringer Laboratories
15000 W. 6th Avenue

Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN:

LGN: 584

RESULTS OF ANALYSIS (cont'd)

Sample Identification	NO_3 as N mg/l	pH units	PO_4 as P mg/l	K Total mg/l	Se Total mg/l	Ag Total mg/l
HER045	<.1	7.29	<.1	35.2	.015	<.01

Sample Identification	SiO_2 mg/l	Na Total mg/l	TDS mg/l	SO_4 mg/l	Zn Total mg/l	Gross Alpha (Total) pCi/liter Precision*
HER045	9.9	128	3380	2260	.082	4600 ± 100

Sample Identification	Gross Beta (Total) pCi/liter ±Precision*	Ra-226 (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/l
HER045	1480 ± 30	480 ± 10	0.7 ± 0.8	0.025

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

BARRINGER LABORATORIES INC.

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1455 DEMING WAY SUITE 15
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18-Dec-89

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Page: 1
Copy: 1 of 3
Set : 1

Authority:
Project :

Purchase order :

Job: 891214E Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	NH4 as N mg/l	As Total mg/l	Ba Total mg/l	HCO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l
HERO 48	150	0.3	0.008	0.02	150	<0.005	542
HERO 49	116	14.5	0.530	0.01	116	<0.005	521
HERO 50	203	0.3	0.006	0.01	203	<0.005	510

Sample	Cl Total mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HERO 48	40	<0.01	3470	<0.01	1.28	11.60	<0.02	186
HERO 49	38	<0.01	3820	0.02	1.35	0.25	0.03	187
HERO 50	38	<0.01	3590	<0.01	0.98	1.11	<0.02	162

Sample	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Total mg/l	Se Total mg/l
HERO 48	0.49	<0.0002	0.02	<0.1	6.92	<0.1	24.2	0.009
HERO 49	0.08	<0.0002	6.45	31.4	6.69	<0.1	36.1	0.017
HERO 50	0.02	<0.0002	0.01	<0.1	7.05	<0.1	36.4	0.011

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18-Dec-89

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One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E Status: Final

AMENDED REPORT

Sample Type: Water

Sample	SiO2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HERO 48	11.5	<0.01	76.0	3440	2280	<0.005	19	±18
HERO 49	11.2	0.02	97.8	3530	2300	0.156	29800	±300
HERO 50	9.9	<0.01	144.0	3320	2190	0.009	1400	±100

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HERO 48	41	±10	3.3	±0.6	0.2	±0.5	0.0041
HERO 49	10100	±100	60	±3	710	±20	18.4
HERO 50	150	±10	350	±10	1.7	±0.9	0.025

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18-Dec-89

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Page: 3
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Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

Abbreviations:

Analyses:

NH4 as N	: Ammonia
As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
Mo	: Molybdenum
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids

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18-Dec-89

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Page: 4
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AMENDED REPORT

SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

BARRINGER LABORATORIES INC.

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18-Dec-89

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 9/27/89 By: T.Moncreif Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH/Zn Acetate
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Swanson	10/5
NH4	1	350.1	0.1 mg/l	2	Hobbs	10/5
As	1	206.2	0.001 mg/l	1	Gilleland	10/4
Ba	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cd	1	200.7	0.005 mg/l	1	Hidalgo	10/20
Ca	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cl	1	325.2	1 mg/l	3	Hobbs	10/4
Cr	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/5
Cu	1	200.7	0.01 mg/l	1	Hidalgo	10/20
F	1	340.2	0.05 mg/l	3	Acree	10/12
Fe	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Pb	1	200.7	0.02 mg/l	1	Hidalgo	10/20
Mg	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Mn	1	200.7	0.01 mg/l	1	Hidalgo	10/20

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18-Dec-89

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ENERGY FUELS CORPORATION
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1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E Status: Final

AMENDED REPORT

Hg	1	245.1	0.0002	mg/l	1	Swanson	10/2
Mo	1	200.7	0.01	mg/l	1	Hidalgo	10/20
NO3	1	353.1	0.1	mg/l	2	Hobbs	10/3
pH	1	210.1	0.01	unit	3	Acree	10/2
PO4	1	365.1	0.1	mg/l	3	Hobbs	10/11
K	1	200.7	0.5	mg/l	1	Hidalgo	10/20
Se	1	270.2	0.001	mg/l	1	Gilleland	10/4
SiO2	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Ag	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Na	1	200.7	0.01	mg/l	1	Hidalgo	10/20
TDS	1	160.1	10	mg/l	3	Acree	10/3
SO4	1	375.3	5	mg/l	3	Acree	10/3
Zn	1	200.7	0.005	mg/l	1	Hidalgo	10/20
Gr.Alpha	4	900.0	1.0	pCi/l	3	Seidel	11/16-12/1
Gr.Beta	4	900.0	2.0	pCi/l	3	Seidel	11/16-12/1
Ra-226	4,7,14	903.0,903.1	0.2	pCi/l	3	Howard	10/31-11/2
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/6-11/10
U	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Tonning	10/17-11/20
U(RR)	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Krizman,Tonning	12/11-12/18

BARRINGER LABORATORIES INC.

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18-Dec-89

Bill Almas
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One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HERO 50	Alkalinity	203	203	0.0
HERO 50	NH4	.34	.34	0.0
HERO 50	As	.006	.006	0.0
HERO 50	Ba	.01	.01	0.0
HERO 50	Cd	<.005	<.005	0.0
HERO 50	Ca	510	511	0.2
HERO 50	Cl	38.2	38.2	0.0
HERO 50	Cr	.01	<.01	---
HERO 50	Sp.Cond.	3590	3590	0.0
HERO 50	Cu	<.01	<.01	0.0
HERO 50	Fe	1.11	1.11	0.0
HERO 50	Pb	<.02	<.02	0.0
HERO 50	Mg	162	161	0.6
HERO 50	Hg	<.0002	<.0002	0.0
HERO 50	Mo	.01	<.01	---
HERO 50	NO3	<.1	<.1	0.0
HERO 50	PO4	<.1	<.1	0.0
HERO 50	K	36.4	36.0	1.0
HERO 50	Se	.010	.011	9
HERO 50	SiO2	9.9	9.9	0.0
HERO 50	Ag	<.01	<.01	0.0
HERO 50	Na	144	143	0.7
HERO 50	Zn	.009	.008	---
HERO 50	U	.025	.025	0.0
HERO 48	U(RR)	.0044	.0039	6.0

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18-Dec-89

Bill Almas
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Suite 2500
Denver, CO 80202

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
NH4	2.05	1.98	1.78 - 2.18	3.5	108
As	.104	.100	.080 - .118	4	92
Ba	.96	.97	.87 - 1.07	1	94
Cd	.189	.200	.180 - .220	5.5	77
Ca	247	250	225 - 275	1.2	---
Cl	26.16	26.05	24.1 - 27.7	0.4	---
Cr	.201	.200	.180 - .220	0.5	97
Cu	.199	.200	.180 - .220	0.5	93
F	.49	.50	.45 - .55	2.0	116
Fe	.198	.200	.180 - .220	1.0	109
Pb	.204	.200	.180 - .220	2.0	79
Mg	255	250	225 - 275	2.0	---
Mn	.198	.200	.180 - .220	1.0	91
Hg	.005	.005	.004 - .006	0.0	100
Mo	.198	.200	.180 - .220	1.0	91
NO3	2.04	1.98	1.78 - 2.18	3	---
PO4	.49	.50	.46 - .54	2.0	---
K	9.8	10.0	9.0 - 11.0	2.0	86
Se	.022	.025	.017 - .028	13	---
SiO2	1.03	1.07	.96 - 1.18	4.0	114
Ag	.92	.99	.89 - 1.09	7.0	88
Na	256	250	225 - 275	2.4	---
TDS	1430	1479	1331 - 1627	3.4	---
SO4	1051	1000	900 - 1100	5	---
Zn	.189	.200	.180 - .220	5.5	94
Gr.Alpha	167 ± 4	198	178 - 218	15.7	---
Gr.Beta	157 ± 2	179	161 - 197	12.3	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	97 ± 3	99	94 - 104	2.0	---
U	33	34	32 - 36	2.9	---
U(RR)	32	34	32 - 36	5.9	---

Approved by: _____

ATTACHMENT 4

MINE SUMP WATER ANALYSIS

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1465 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1188

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 583 Client PO No.

Sample Type: water

Date Collected: 6/27/89 Date Received: 7/5/89 Date Reported: 8/7/89

RESULTS OF ANALYSIS

Sample Identification	As Total mg/l	Ba Total mg/l	Cd Total mg/l	Cu Total mg/l	Fe Total mg/l	Pb Total mg/l	Mn Tota mg/
HER043	1.09	.03	.014	.04	.29	<.02	.08

Sample Identification	Hg Total mg/l	NO_3 as N mg/l	Se Total mg/l	Ag Total mg/l	Zn Total mg/l
HER043	.0002	12.8	.042	<.01	.123

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER043	4000 ± 100	1100 ± 30	3.31

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 583

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 7/5/89 By: Gina Reichert Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Mercury	1	245.1	0.2 ug/l	1	M. Swanson	7/12/89
Nitrate	1	353.1	0.1 mg/l	2	D. Hobbs	7/12/89
Arsenic	1	206.2	1 ug/l	1	G. Gilleland	7/13/89
Selenium	1	270.2	1 ug/l	1	D. Hobbs	7/14/89
Barium	1	200.7	10 ug/l	1	D. Hidalgo	8/2/89
Cadmium	1	200.7	5 ug/l	1	D. Hidalgo	8/2/89
Copper	1	200.7	10 ug/l	1	D. Hidalgo	8/2/89
Iron	1	200.7	10 ug/l	1	D. Hidalgo	8/2/89
Lead	1	200.7	2 ug/l	1	D. Hidalgo	8/2/89
Manganese	1	200.7	1 ug/l	1	D. Hidalgo	8/2/89
Silver	1	200.7	10 ug/l	1	D. Hidalgo	8/2/89
Zinc	1	200.7	5 ug/l	1	D. Hidalgo	8/2/89
Alpha-Beta	4		1.0,2.0 pCi/l	3	M. Kidwell	7/19-7/31/89
Uranium	4,14		0.3 ug/l	3	Tonning,Krizman	7/19/89

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER043	Mercury	.0002	.0002	0.0%
HER043	Nitrate	12.8	12.8	0.0%
HER043	Arsenic	1.13	1.09	4.0%
HER043	Selenium	.042	.041	2.4%
HER043	Barium	.03	.03	0.0%
HER043	Cadmium	.014	.018	---
HER043	Copper	.04	.04	0.0%

Approved by _____

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Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 583

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER043	Iron	.29	.29	0.0%
HER043	Lead	<.02	<.02	0.0%
HER043	Manganese	.08	.08	0.0%
HER043	Silver	<.01	<.01	0.0%
HER043	Zinc	.123	.120	0.8%
HER043	Uranium	3.39	3.22	2.6%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Target Range	Relative Deviation From Known	Spike % Recovery
Mercury	.008	.008	.006 - .009	0.0%	100
Nitrate	2.01	1.98	1.78 - 2.18	1.5%	---
Selenium	.022	.025	.017 - .028	13.0%	96
Arsenic	.063	.062	.048 - .078	2.0%	---
Barium	.96	.97	.87 - 1.07	1.0%	96
Cadmium	.212	.200	.180 - .220	6.0%	96
Copper	.206	.200	.180 - .220	3.0%	103
Iron	.208	.200	.180 - .220	4.0%	82
Lead	.203	.200	.180 - .220	1.5%	89
Manganese	.207	.200	.180 - .220	3.5%	102
Silver	.90	.99	.89 - 1.09	9.0%	86
Zinc	.199	.200	.180 - .220	0.5%	108
Gross Alpha	216 ± 4	198	178 - 218	9.1%	---
Gross Beta	175 ± 2	179	161 - 197	2.2%	---
Uranium	1.00	1.00	.95 - 1.05	0.0%	---

Approved by Barbara Cope

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE. SUITE 200
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

18-Dec-89

Bill Almas
ENERGY FUELS CORPORATION
One Tabor Center
1200-17th St.
Suite 2500
Denver, CO 80202

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Set : 1

Authority:
Project :

Purchase order :

Job: 891214E

Status: Final

AMENDED REPORT

Sample Type: Water

Sample	Alkalinity as CaCO3 mg/l	NH4 as N mg/l	As Total mg/l	Ba Total mg/l	HCO3 as CaCO3 mg/l	Cd Total mg/l	Ca Total mg/l
HERO 48	150	0.3	0.008	0.02	150	<0.005	542
HERO 49	116	14.5	0.530	0.01	116	<0.005	521
HERO 50	203	0.3	0.006	0.01	203	<0.005	510

Sample	Cl Total mg/l	Cr Total mg/l	Specific Conductance µmho/cm	Cu Total mg/l	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l
HERO 48	40	<0.01	3470	<0.01	1.28	11.60	<0.02	186
HERO 49	38	<0.01	3820	0.02	1.35	0.25	0.03	187
HERO 50	38	<0.01	3590	<0.01	0.98	1.11	<0.02	162

Sample	Mn Total mg/l	Hg Total mg/l	Mo Total mg/l	NO3 as N mg/l	pH unit	PO4 as P mg/l	K Total mg/l	Se Total mg/l
HERO 48	0.49	<0.0002	0.02	<0.1	6.92	<0.1	24.2	0.009
HERO 49	0.08	<0.0002	6.45	31.4	6.69	<0.1	36.1	0.017
HERO 50	0.02	<0.0002	0.01	<0.1	7.05	<0.1	36.4	0.011

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Sample Type: Water

Sample	SiO2 Total mg/l	Ag Total mg/l	Na Total mg/l	TDS mg/l	SO4 mg/l	Zn Total mg/l	Gross Alpha Total pCi/l	Error 2σ*
HERO 48	11.5	<0.01	76.0	3440	2280	<0.005	19	±18
HERO 49	11.2	0.02	97.8	3530	2300	0.156	29800	±300
HERO 50	9.9	<0.01	144.0	3320	2190	0.009	1400	±100

Sample	Gross Beta Total pCi/l	Error 2σ*	Ra-226 Total pCi/l	Error 2σ*	Th-230 Total pCi/l	Error 2σ*	U Total mg/l
HERO 48	41	±10	3.3	±0.6	0.2	±0.5	0.0041
HERO 49	10100	±100	60	±3	710	±20	18.4
HERO 50	150	±10	350	±10	1.7	±0.9	0.025

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Abbreviations:

Analyses:

NH4 as N	: Ammonia
As	: Arsenic
Ba	: Barium
HCO3	: Bicarbonate
Cd	: Cadmium
Ca	: Calcium
Cl	: Chloride
Cr	: Chromium
Cu	: Copper
F	: Fluoride
Fe	: Iron
Pb	: Lead
Mg	: Magnesium
Mn	: Manganese
Hg	: Mercury
Mo	: Molybdenum
NO3 as N	: Nitrate
PO4 as P	: Phosphate
K	: Potassium
Se	: Selenium
SiO2	: Silica
Ag	: Silver
Na	: Sodium
TDS	: Total Dissolved Solids

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SO4	: Sulfate
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium

Units:

mg/l	: milligrams per liter
µmho/cm	: micromhos per centimeter at 25C
pCi/l	: picoCuries per liter
2σ*	: * Counting error at the 95% confidence level, 2σ

Quality control:

<	: less than

Signed:

.....

Gary Zito
Laboratory Supervisor

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AMENDED REPORT

QUALITY CONTROL DATA SHEET

Time Received: 9:00 Date: 9/27/89 By: T.Moncreif Via: UPS

Sample Container Type: large cube, small cube
Sample Type: water
Preservative When Received: 1.HNO3 2.H2SO4 3.none 4.NaOH/Zn Acetate
Additional Lab Preparation: none

Parameter	Ref	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Alkalinity	1	210.1	1 mg/l	3	Swanson	10/5
NH4	1	350.1	0.1 mg/l	2	Hobbs	10/5
As	1	206.2	0.001 mg/l	1	Gilleland	10/4
Ba	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cd	1	200.7	0.005 mg/l	1	Hidalgo	10/20
Ca	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Cl	1	325.2	1 mg/l	3	Hobbs	10/4
Cr	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Sp.Cond.	1	120.1	0.001 µmho/cm	3	Hencmann	10/5
Cu	1	200.7	0.01 mg/l	1	Hidalgo	10/20
F	1	340.2	0.05 mg/l	3	Acree	10/12
Fe	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Pb	1	200.7	0.02 mg/l	1	Hidalgo	10/20
Mg	1	200.7	0.01 mg/l	1	Hidalgo	10/20
Mn	1	200.7	0.01 mg/l	1	Hidalgo	10/20

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Hg	1	245.1	0.0002	mg/l	1	Swanson	10/2
Mo	1	200.7	0.01	mg/l	1	Hidalgo	10/20
NO3	1	353.1	0.1	mg/l	2	Hobbs	10/3
pH	1	210.1	0.01	unit	3	Acree	10/2
PO4	1	365.1	0.1	mg/l	3	Hobbs	10/11
K	1	200.7	0.5	mg/l	1	Hidalgo	10/20
Se	1	270.2	0.001	mg/l	1	Gilleland	10/4
SiO2	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Ag	1	200.7	0.01	mg/l	1	Hidalgo	10/20
Na	1	200.7	0.01	mg/l	1	Hidalgo	10/20
TDS	1	160.1	10	mg/l	3	Acree	10/3
SO4	1	375.3	5	mg/l	3	Acree	10/3
Zn	1	200.7	0.005	mg/l	1	Hidalgo	10/20
Gr.Alpha	4	900.0	1.0	pCi/l	3	Seidel	11/16-12/1
Gr.Beta	4	900.0	2.0	pCi/l	3	Seidel	11/16-12/1
Ra-226	4,7,14	903.0,903.1	0.2	pCi/l	3	Howard	10/31-11/2
Th-230	11	---	0.2	pCi/l	3	Jackson,Ortiz	11/6-11/10
U	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Tonning	10/17-11/20
U(RR)	4,9,10,14	(ASTM)D2907	0.3	µg/l	3	Krizman,Tonning	12/11-12/18

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DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation % From Mean
HERO 50	Alkalinity	203	203	0.0
HERO 50	NH4	.34	.34	0.0
HERO 50	As	.006	.006	0.0
HERO 50	Ba	.01	.01	0.0
HERO 50	Cd	<.005	<.005	0.0
HERO 50	Ca	510	511	0.2
HERO 50	Cl	38.2	38.2	0.0
HERO 50	Cr	.01	<.01	---
HERO 50	Sp.Cond.	3590	3590	0.0
HERO 50	Cu	<.01	<.01	0.0
HERO 50	Fe	1.11	1.11	0.0
HERO 50	Pb	<.02	<.02	0.0
HERO 50	Mg	162	161	0.6
HERO 50	Hg	<.0002	<.0002	0.0
HERO 50	Mo	.01	<.01	---
HERO 50	NO3	<.1	<.1	0.0
HERO 50	PO4	<.1	<.1	0.0
HERO 50	K	36.4	36.0	1.0
HERO 50	Se	.010	.011	9
HERO 50	SiO2	9.9	9.9	0.0
HERO 50	Ag	<.01	<.01	0.0
HERO 50	Na	144	143	0.7
HERO 50	Zn	.009	.008	---
HERO 50	U	.025	.025	0.0
HERO 48	U(RR)	.0044	.0039	6.0

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QUALITY CONTROL STANDARDS

Parameter	Result	Cert. Result	Target Range	Relative Deviation % From Known	Spike % Recovery
NH4	2.05	1.98	1.78 - 2.18	3.5	108
As	.104	.100	.080 - .118	4	92
Ba	.96	.97	.87 - 1.07	1	94
Cd	.189	.200	.180 - .220	5.5	77
Ca	247	250	225 - 275	1.2	---
Cl	26.16	26.05	24.1 - 27.7	0.4	---
Cr	.201	.200	.180 - .220	0.5	97
Cu	.199	.200	.180 - .220	0.5	93
F	.49	.50	.45 - .55	2.0	116
Fe	.198	.200	.180 - .220	1.0	109
Pb	.204	.200	.180 - .220	2.0	79
Mg	255	250	225 - 275	2.0	---
Mn	.198	.200	.180 - .220	1.0	91
Hg	.005	.005	.004 - .006	0.0	100
Mo	.198	.200	.180 - .220	1.0	91
NO3	2.04	1.98	1.78 - 2.18	3	---
PO4	.49	.50	.46 - .54	2.0	---
K	9.8	10.0	9.0 - 11.0	2.0	86
Se	.022	.025	.017 - .028	13	---
SiO2	1.03	1.07	.96 - 1.18	4.0	114
Ag	.92	.99	.89 - 1.09	7.0	88
Na	256	250	225 - 275	2.4	---
TDS	1430	1479	1331 - 1627	3.4	---
SO4	1051	1000	900 - 1100	5	---
Zn	.189	.200	.180 - .220	5.5	94
Gr.Alpha	167 ± 4	198	178 - 218	15.7	---
Gr.Beta	157 ± 2	179	161 - 197	12.3	---
Ra-226	108 ± 3	101	96 - 106	7.0	---
Th-230	97 ± 3	99	94 - 104	2.0	---
U	33	34	32 - 36	2.9	---
U(RR)	32	34	32 - 36	5.9	---

Approved by: _____

	A	B	C	D	E	F	G	H	I
1	PARAMETER,UNIT	HR 012	HR 019	HR 025	HR 032	HER 041	PREMINING	SAMPLE STANDARD	MAXIMUM ACCEPTABLE
2		04-28-88	~~06-29-89~~ 06-29-88	~~09-29-89~~ 09-29-88	12-23-88	05-31-89	SAMPLE MEAN	DEVIATION	VALUE
3									
4	As,mg/l	0.013	0.015	0.02	0.006	0.008	0.012	0.0060	0.0241
5	Ba,mg/l	0.01	0.02	0.04	0.04	0	0.022	0.0179	0.0578
6	Cd,mg/l	0	0.025	0	0	0	0.005	0.0112	0.0274
7	Cu,mg/l	0.01	0.02	0.02	0.04	0.02	0.022	0.0110	0.0439
8	Fe,mg/l	4.03	7.48	6.21	7.33	9.85	6.98	2.1157	11.2114
9	Pb,mg/l	0	0.15	0	0	0	0.03	0.0671	0.1642
10	Mn,mg/l	0.06	0.11	0.09	0.1	0.17	0.106	0.0404	0.1867
11	Hg,mg/l	0.0011	0.0011	0.0003	0	0.0002	0.00054	0.0005	0.0016
12	Se,mg/l	0.009	0	0.037	0.012	0.018	0.0152	0.0138	0.0428
13	Ag,mg/l	0.01	0.02	0.02	0	0	0.01	0.0100	0.0300
14	Zn,mg/l	0	0.118	0.07	0.136	0.015	0.0678	0.0603	0.1885
15	U,mg/l	0.0025	0.0025	0.0022	0.0024	0.0029	0.0025	0.0003	0.0030
16	Alk as CaC03,mg/l	159	155	157	157	159	157.4	1.6733	160.7466
17	HC03 as CaC03	159	155	157	157	159	157.4	1.6733	160.7466
18	C03,mg/l	0	0	0	0	0	0	0.0000	0.0000
19	Ca,mg/l	585	577	494	533	546	547	36.5718	620.1437
20	Cl,mg/l	43	41	42.3	40.1	39.6	41.2	1.4370	44.0740
21	Cr,mg/l	0.1	0.15	0.13	0.01	0.01	0.08	0.0663	0.2127
22	F,mg/l	1.47	1.39	1.32	1.41	1.26	1.37	0.0815	1.5331
23	Mg,mg/l	183	192	169	177	187	181.6	8.9331	199.4662
24	P04,mg/l	0	0	0	0	0	0	0.0000	0.0000
25	K,mg/l	25.3	24.4	19.4	21.6	25.7	23.28	2.6957	28.6715
26	Si02,mg/l	13.6	12.8	11	12.6	12.1	12.42	0.9602	14.3404
27	Na,mg/l	70.1	78.8	69.5	73.6	82	74.8	5.4649	85.7298
28	S04,mg/l	2230	2240	2080	2220	2360	2226	99.3982	2424.7964
29	TDS,mg/l	3500	3450	3430	3430	3470	3456	29.6648	3515.3296
30	N03 as N,mg/l	0.7	0	0	0	0	0.14	0.3130	0.7661
31	Gross alpha, pCi/l	0	0	76	12	14	20.4	31.7616	83.9232
32	Gross beta, pCi/l	31	27	38	30	39	33	5.2440	43.4881
33	Th230, pCi/l	0	0.7	0.4	0.6	0	0.34	0.3286	0.9973
34	Ra226,mg/l	3.5	2.6	0.4	2.1	1.2	1.96	1.2054	4.3708
35	Electrical conductiv	3430	3210	3340	3440	3200	3324	115.4556	3554.9112
36	umhos/cm								0.0000
37	pH,units	8.02		7.2	7.4	7.59	7.5525	0.3500	8.2525
38	TSS,mg/l	18		14	9	88	32.25	37.3486	106.9472

EXHIBIT #2

Hermit Mine Premining Groundwater Quality

HERMIT MINE MINING PHASE GRW QUALITY 6-MAR-90 09:09:53 Pg 1

	A	B	C	D	E	F	G	H
1	PARAMETERS,	PREMINING	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	MAXIMUM
2	UNITS	SAMPLE	STANDARD	HER 044	HER 048	HER 051	HER 052	ACCEPTABLE
3		MEAN	DEVIATION	08-29-89	09-21-89	10-19-89	12-07-89	VALUE
4								
5	As,mg/l	0.012	0.0060	0.004	0.008	0.022	0.0080	0.0241
6	Ba,mg/l	0.022	0.0179	0.02	0.02	0.01	0.0200	0.0578
7	Cd,mg/l	0.005	0.0112	0.006	0	0	<0.005	0.0274
8	Cu,mg/l	0.022	0.0110	0.02	0	0	0.0200	0.0439
9	Fe,mg/l	6.98	2.1157	12	11.6	4.71	1.1300	11.2114
10	Pb,mg/l	0.03	0.0671	<0.02	<0.02	<0.02	<0.02	0.1642
11	Mn,mg/l	0.106	0.0404	0.23	0.49	0.39	0.2500	0.1867
12	Hg,mg/l	0.00054	0.0005	0	0	0	0.0002	0.0016
13	Se,mg/l	0.0152	0.0138	0.02	0.009	0.023	0.0060	0.0428
14	Ag,mg/l	0.01	0.0100	0	0	0		0.0300
15	Zn,mg/l	0.0678	0.0603	0.077	0	0.013	0.2580	0.1885
16	U, Total mg/l	0.0025	0.0003	0.0035	0.0043	0.0064	0.024	0.0030
17	Alk as CaCO3,mg/l	157.4	1.6733		150	0	155.0000	160.7466
18	HCO3 as CaCO3,mg/l	157.4	1.6733		150	150	155	160.7466
19	CO3,mg/l	0	0.0000			0		0.0000
20	Ca,mg//l	547	36.5718		542	547	466.0000	620.1437
21	Cl,mg/l	41.2	1.4370		40	39	52.0000	44.0740
22	Cr,mg/l	0.08	0.0663		<0.01	0.01	<0.01	0.2127
23	F,mg/l	1.37	0.0815		1.28	1.43	1.3000	1.5331
24	Mg,mg/l	181.6	8.9331		186	201	155.0000	199.4662
25	PO4,mg/l	0	0.0000		<0.1	<0.1	<0.1	0.0000
26	K,mg/l	23.28	2.6957		24.2	31.6	44.5000	28.6715
27	SiO2,mg/l	12.42	0.9602		11.5	9.8	8.9000	14.3404
28	Na,mg/l	74.8	5.4649		76	102	138.0000	85.7298
29	SO4,mg/l	2226	99.3982		2280	2280	2280.0000	2424.7964
30	TDS,mg/l	3456	29.6648		3440	3220	3310.0000	3515.3296
31	NO3 as N,mg/l	0.14	0.3130		0	0	<0.1	0.7661
32	Gross alpha,pCi/l	20.4	31.7616	28	19	78	22.0000	83.9232
33	Gross beta,pCi/l	33	5.2440	40	41	54	68.0000	43.4881
34	Th230,pCi/l	0.34	0.3286		0.2	0	3.1000	0.9973
35	Ra226,pCi/l	1.96	1.2054		3.3	0.8	2.4000	4.3708
36	Electrical conductivity,	3324	115.4556		3470	3600	3470.0000	3554.9112
37	umhos/cm	0	0.0000					0.0000
38	pH,units	7.5525	0.3500		6.92		7.2900	6.8525
39	TSS,mg/l	32.25	37.3486					0.0000
40	U,Dissolved mg/l							

	A	B	C	D	E	F	G
1	PARAMETERS,	PREMINING	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	SAMPLE RESULTS	MAXIMUM
2	UNITS	SAMPLE	STANDARD	HER 044	HER 048	HER 051	ACCEPTABLE
3		MEAN	DEVIATION	06-29-89	09-21-89	10-19-89	VALUE
4							
5	As,mg/l	0.012	0.0060	0.004	0.008	0.022	0.0241
6	Ba,mg/l	0.022	0.0179	0.02	0.02	0.01	0.0578
7	Cd,mg/l	0.005	0.0112	0.006	0	0	0.0274
8	Cu,mg/l	0.022	0.0110	0.02	0	0	0.0439
9	Fe,mg/l	6.98	2.1157	12	11.6	4.71	11.2114
10	Pb,mg/l	0.03	0.0671	0	0	0	0.1642
11	Mn,mg/l	0.106	0.0404	0.23	0.49	0.39	0.1867
12	Hg,mg/l	0.00054	0.0005	0	0	0	0.0016
13	Se,mg/l	0.0152	0.0138	0.02	0.009	0.023	0.0428
14	Ag,mg/l	0.01	0.0100	0	0	0	0.0300
15	Zn,mg/l	0.0678	0.0603	0.077	0	0.013	0.1885
16	U,mg/l	0.0025	0.0003	0.0035	0.0043	0.0064	0.0030
17	Alk as CaCO3,mg/l	157.4	1.6733		150	0	160.7466
18	HCO3 as CaCO3,mg/l	157.4	1.6733		150	150	160.7466
19	CO3,mg/l	0	0.0000			0	0.0000
20	Ca,mg//l	547	36.5718		542	547	620.1437
21	Cl,mg/l	41.2	1.4370		40	39	44.0740
22	Cr,mg/l	0.08	0.0663		0	0.01	0.2127
23	F,mg/l	1.37	0.0815		1.28	1.43	1.5331
24	Mg,mg/l	181.6	8.9331		186	201	199.4662
25	PO4,mg/l	0	0.0000		0	0	0.0000
26	K,mg/l	23.28	2.6957		24.2	31.6	28.6715
27	SiO2,mg/l	12.42	0.9602		11.5	9.8	14.3404
28	Na,mg/l	74.8	5.4649		76	102	85.7298
29	SO4,mg/l	2226	99.3982		2280	2280	2424.7964
30	TDS,mg/l	3456	29.6648		3440	3220	3515.3296
31	NO3 as N,mg/l	0.14	0.3130		0	0	0.7661
32	Gross alpha,pCi/l	20.4	31.7616	28	19	78	83.9232
33	Gross beta,pCi/l	33	5.2440	40	41	54	43.4881
34	Th230,pCi/l	0.34	0.3286		0.2	0	0.9973
35	Ra226,pCi/l	1.96	1.2054		3.3	0.8	4.3708
36	Electrical conductivity,	3324	115.4556		3470	3600	3554.9112
37	umhos/cm	0	0.0000				0.0000
38	pH,units	7.5525	0.3500		6.92		6.8525
39	TSS,mg/l	32.25	37.3486				0.0000
40							

TABLE II

Mining Water Quality Results

Hermit Supply Well

HERMIT MINE
PREMINING
WATER QUALITY
REPORT

TO

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

SUBMITTED

BY

ENERGY FUELS NUCLEAR, INC.
ONE TABOR CENTER
1200 SEVENTEENTH STREET, SUITE 2500
DENVER, COLORADO 80202



FEBRUARY 12, 1990

Hermit Mine
Premining
Water Quality Data Report

Pursuant to Requirements
Contained Within Groundwater Protection Permit G-0035-08

Premining Water Quality Baseline Determination

During the period between construction of the surface facility and mining activity, five quarterly samples from the Monitor/Production Well identified as Well Registry #55-518877 were collected and analyzed. Four of the quarterly samples have been submitted previously to the Arizona Department of Environmental Quality. Sample results from the fifth quarterly sample are included in this Report as Exhibit 1.

Pursuant to requirements contained within the Hermit Mine Groundwater Protection Permit, the premining mean average concentration and sample standard deviation were calculated for parameters specified in part II.B.2.b. These calculations provide a water quality baseline and establish Maximum Groundwater Limits for monitor well samples during the mining phase. A summary of the analytical results making up the premining baseline and calculations are shown on Exhibit 2.

Groundwater Inflow to Shaft and Mine Development Workings

Exhibit 3 illustrates mine inflows for the premining period. Groundwater was initially encountered during shaft sinking on June 15, 1988. Groundwater was first encountered 902 feet below the shaft collar elevation (3,984 feet MSL) at the Coconino sandstone-Toroweap limestone formation contact. Inflows were estimated at 2 gpm based on pump capacity and operating hours. Inflow steadily increased from 2 gpm to 15 gpm as shaft construction proceeded to 942 feet below shaft collar elevation

(3944 feet MSL). The unsaturated Hermit shale contact was encountered at this elevation and no additional saturated zones were encountered during shaft construction. During July, 1988, a grouting program was initiated at the Coconino-Hermit formation contact which effectively reduced inflow to about 7 gpm. Thereafter, groundwater inflows to the shaft and development mine workings increased steadily due principally to development of a mine adit at the 3970 feet MSL elevation. This adit was driven off the main shaft, following the Coconino-Toroweap formation contact outside of the breccia pipe. Development of the mine adit significantly increased total surface area open to groundwater inflow resulting in increased flow. Total mine water was made up almost entirely of water from the Coconino-Toroweap formations with only an estimated 2 gpm entering the mine development workings at all other locations.

A groundwater sampling monitor point was established at an elevation of 908 feet below the shaft collar at an elevation of 3976 feet MSL. The monitor point is a diamond drill core hole which penetrates the Coconino and Toroweap formations. Analytical information from water collected from this zone has been presented in previous quarterly reports, specifically, samples HR023 and HR033. Second Quarter, 1989 Shaft Water Analysis results are identified as HER 042 in Exhibit 1. The approximate location of the monitoring point is identified on Plate 1.

Mine Configuration

The development of the surface plant was performed in accordance with the approved Plan of Operations submitted to the Bureau of Land Management as described in the Hermit Mine Notice of Intent to Mine filed with the ADEQ. A total of approximately 24 acres has been disturbed, including two water evaporation ponds. Plate 2 illustrates the current surface plant configuration.

Underground workings, as of June 30, 1989, are illustrated in a side view in Plate 1.

Permeability of the Mine Sump

As part of the documentation needed for the application for the Groundwater Protection Permit at the Hermit Mine, EFN contracted with Canonie Environmental Services Corporation (Canonie) to assess potential impacts to groundwater at the site. The report, "Potential Impacts of Mining on Groundwater Resources", was submitted January, 1988. In part, the study looked at the permeability porosity and specific retention of rock within the breccia pipe and in surrounding formations. Rock core samples were obtained from the mining zone and the zones below mining both inside and outside of the pipe. Care was taken to select rock samples representative of the rocks surrounding the mining zone.

Core material selected for determining Hermit shale permeability was obtained at approximately the same elevation, and within 500 feet, of the Hermit mine sump. Canonie concluded that Hermit shale and breccia material are essentially impermeable with gas permeabilities ranging from a 10^{-8} cm/sec. to 10^{-9} cm/sec. This range represents values one to two orders of magnitude below the levels at which materials are commonly considered impermeable for hydrogeological and geotechnical engineering applications.

A copy of the portion of the report, which discusses physical parameters influencing migration of mine water, is attached as Exhibit 4.

EXHIBIT I

SECOND QUARTER, 1989
WATER QUALITY ANALYSIS

SEND TO: BARRINGER LABS
15,000 WEST 6TH AVE SUITE 300
GOLDEN, COLORADO 80401

CHAIN OF CUSTODY RECORD - CLIENT COPY

SENT FROM:

Sampler's Name: LAWRENCE L. CASEBOLT
Company Name: ENERGY FUELS NUCLEAR INC
Company Address: P.O. BOX 36 FREDONIA, AZ. 86022

I.D. #	Client I.D. #	Sample Location	Date/Time of Sampling	Raw, Unfiltered, Plastic	Raw, Filtered, Plastic	Raw, Filtered, Glass	HNO_3, Filtered, Plastic	H_2SO_4, Filtered, Plastic	NaOH + Zn Acetate, Filtered, Plastic			Total Number of Bottles	(Instructions for Analysis on back of form) Comments
	HER041	HERMIT MINE WATER WELL	5/31/89 / 3:53 PM	1			1	1	1			4	✓
	HER042	HERMIT MINE SHAFT	5/31/89 / 5:00 PM	1			1	1	1			4	✓
	PN040	PINENUT MINE WATER WELL	5/31/89 / 12:17 PM	1			1	1	1			4	✓

Relinguished By: (Signature)	Date/Time	Received By: (Signature)	Date/Time
Lawrence L. Casebolt	6-1-89 / 9:30 AM	Dina Reichert	6/2/89 9:30 A.M.
Relinguished By: (Signature)	Date/Time	Received for BLI By: (Signature)	Date/Time

Shipping Information
Carrier: FEDERAL EXPRESS
Date Shipped: 6-1-89

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

Client No. Log No. 344 Client PO No.

Sample Type: water

Date Collected: 5/31/89 Date Received: 6/2/89 Date Reported: 7/21/89

RESULTS OF ANALYSIS

Sample Identification	Alkalinity as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	CO_3 as $CaCO_3$ mg/l	As Total mg/l	Ba Total mg/l
HER041 supply well	159	159	<1	.006	<.01
HER042 2nd Q shaft	209	209	<1	.007	<.01
~~PN040~~ (Pinenut)	204	204	<1	<.001	.01

Sample Identification	Cd Total mg/l	Ca Total mg/l	Cl mg/l	Cr Total mg/l	Conductance umhos/cm	Cu Total mg/l
HER041	.005	546	39.6	.01	3200	.02
HER042	.005	514	28.4	.02	3170	.02
PN040	.005	181	20.1	<.01	1860	.02

Sample Identification	F mg/l	Fe Total mg/l	Pb Total mg/l	Mg Total mg/l	Mn Total mg/l	Hg Total mg/l	NO_3 as N mg/l
HER041	1.26	9.85	<.02	187	.17	.0002	<.1
HER042	1.07	1.01	<.02	166	.05	.0003	<.1
PN040	.73	8.52	<.02	127	.51	.0002	<.1

Approved by D. Fahn

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

Sample Identification	pH units	PO_4 as P mg/l	K Total mg/l	Se Total mg/l	SiO_2 mg/l	Ag Total mg/l	Na Total mg/l
HER041	7.59	<.1	25.7	.018	12.1	<.01	82.0
HER042	7.68	<.1	32.8	.019	9.37	<.01	134
PN040	7.84	<.1	28.9	.016	8.68	<.01	79.8

Sample Identification	TDS mg/l	TSS mg/l	SO_4 mg/l	Zn Total mg/l	S mg/l	Ra-226 (Total) pCi/liter ±Precision*
HER041	3470	88	2360	.015	<2	1.2 ± 0.4
HER042	3360	<4	2190	.055	<2	230 ± 10
PN040	1610	66	1010	.036	<2	15 ± 1

Sample Identification	Gross Alpha (Total) pCi/liter ±Precision*	Gross Beta (Total) pCi/liter ±Precision*	Th-230 (Total) pCi/liter ±Precision*	Uranium (Total) mg/liter
HER041 well	14 ± 20	39 ± 11	0.0 ± 0.5	0.0029
HER042 spring	1600 ± 100	400 ± 20	0.1 ± 0.4	~~0.0245~~
PN040	65 ± 14	44 ± 6	0.1 ± 0.4	0.0067

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by D. Parker

Barringer Laboratories
15000 W. 6th Avenue
Suite 300
Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET

Time Received: 9:30 Date: 6/2/89 By: Gina Reichert Via: Fed. Express

Sample Container Type: large cube, small cube
Sample Type: water

Preservative When Received: 1. HNO_3 2. H_2SO_4 3. None 4. NaOH

Additional Lab Preparation: None

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Nitrate	1	353.1	0.1 mg/1	2	D. Hobbs	6/6/89
Chloride	1	325.2	0.2 mg/1	3	D. Hobbs	6/7/89
Phosphate	1	365.1	0.01 mg/1	3	D. Hobbs	6/12/89
Mercury	1	245.1	0.2 ug/1	1	M. Swanson	6/15/89
Barium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Cadmium	1	200.7	5 ug/1	1	D. Hidalgo	6/19/89
Calcium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Chromium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Copper	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Iron	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Lead	1	200.7	2 ug/1	1	D. Hidalgo	6/19/89
Magnesium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Manganese	1	200.7	1 ug/1	1	D. Hidalgo	6/19/89
Potassium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Silica	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Selenium	1	270.2	1 ug/1	1	G. Gilleland	6/23/89
Conductance	1	120.1	0.1 umhos/cm	3	A. Knudson	6/26/89
Alkalinity	1	210.1	0.5 mg/1	3	M. Swanson	6/26/89
Arsenic	1	206.2	1 ug/1	1	G. Gilleland	6/27/89
pH	1	150.1	0.01 units	3	A. Knudson	6/28/89
Fluoride	1	340.2	0.1 mg/1	3	A. Knudson	6/29/89
Silver	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Sodium	1	200.7	10 ug/1	1	D. Hidalgo	6/19/89
Zinc	1	200.7	5 ug/1	1	D. Hidalgo	6/19/89
TSS	1	160.2	4 mg/1	3	A. Knudson	6/26/89
TDS	1	160.1	10 mg/1	3	A. Knudson	6/26/89
Sulfate	1	375.3	0.1 mg/1	3	A. Knudson	6/26/89

Approved by D. Parker

Barringer Laboratories
15000 W. 6th Avenue
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Golden, CO 80401
(303) 277-1687

Energy Fuels
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET (cont'd)

Parameter	Reference	Method	LLD	Preservative	Analyst	Date(s) of Analysis
Sulfite	1	377.1	1 mg/1	3	A. Knudson	6/28/89
Alpha-Beta	4		1.0,2.0 pCi/1	3	M. Kidwell	7/6-7/12/89
Radium 226	4,7		0.2 pCi/1	3	Howard, Barkey	7/7-7/13/89
Thorium 230	11		0.2 pCi/1	3	Jackson, Ortiz	6/29-7/7/89
Uranium	4,14		0.3 ug/1	3	Tonning,Krizman	7/7-7/10/89

DUPLICATES

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
PN040	Nitrate	<.1	<.1	0.0%
PN040	Chloride	20.1	20.1	0.0%
PN040	Phosphate	<.1	<.1	0.0%
PN040	Mercury	.0002	.0003	---
PN040	Barium	.01	.01	0.0%
PN040	Cadmium	<.005	<.005	0.0%
PN040	Calcium	181	180	0.6%
PN040	Chromium	<.01	<.01	0.0%
PN040	Copper	.02	.02	0.0%
PN040	Iron	8.52	8.45	0.8%
PN040	Lead	<.02	<.02	0.0%
PN040	Magnesium	127	126	0.8%
PN040	Manganese	.51	.51	0.0%
PN040	Potassium	28.9	28.5	1.4%
PN040	Silica	8.68	8.64	0.5%
PN040	Selenium	.019	.020	5.0%
HER042	Conductance	3170	3170	0.0%
PN040	Alkalinity	203	205	1.0%
PN040	Arsenic	<.001	<.001	0.0%
PN040	pH	7.84	7.83	0.1%
HER041	Fluoride	1.24	1.27	2.4%
PN040	Silver	<.01	<.01	0.0%
PN040	Sodium	79.8	78.9	1.1%
PN040	Zinc	.036	.036	0.0%
PN040	TSS	65	67	3.0%

Approved by _____

Barringer Laboratories
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Energy Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET (cont'd)

DUPLICATES (cont'd)

Sample Identification	Parameter	Result	Result	Relative Deviation From Mean
HER041	TDS	3470	3480	0.3%
HER042	Sulfate	2160	2230	3.2%
HER042	Sulfite	<2	<2	0.0%
PN040	Uranium	0.0069	0.0064	3.8%

QUALITY CONTROL STANDARDS

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Known	Spike % Recovery
Nitrate	2.14	1.98	1.78 - 2.18	7.8%	---
Chloride	25.6	26.05	24.1 - 27.7	1.6%	---
Phosphate	.47	.50	.46 - .54	6.2%	---
Mercury	.006	.005	.004 - .006	---	100
Barium	.92	.97	.87 - 1.07	5.0%	91
Cadmium	.197	.200	.180 - .220	1.5%	99
Calcium	243	250	225 - 275	2.8%	---
Chromium	.196	.200	.180 - .220	2.0%	98
Copper	.205	.200	.180 - .220	2.5%	100
Iron	.199	.200	.180 - .220	0.5%	---
Lead	.194	.200	.180 - .220	3.0%	93
Magnesium	.197	.200	.180 - .220	1.5%	---
Manganese	.197	.200	.180 - .220	1.5%	95
Potassium	9.31	10.0	9.0 - 11.0	6.9%	82
Silica	.97	1.07	.96 - 1.18	9.0%	---
Selenium	.025	.025	.017 - .028	0.0%	88
Arsenic	.099	.100	.080 - .118	1.0%	76
Fluoride	.48	.50	.45 - .55	4.1%	90
Silver	.90	.99	.89 - 1.09	9.0%	86
Sodium	253	250	225 - 275	1.2%	---
Zinc	.203	.200	.180 - .220	1.5%	107
TDS	1490	1470	1331 - 1627	0.7%	---
Sulfate	1067	1000	900 - 1100	6.7%	---
Gross Alpha	210 ± 4	198	178 - 218	6.1%	---
Gross Beta	168 ± 1	179	161 - 197	6.1%	---
Radium 226	95 ± 2	101	96 - 106	6.0%	---
Thorium 230	99 ± 3	99	94 - 104	0.0%	---

Approved by _____

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Energu Fuels, Inc.
P.O. Box 36
Fredonia, AZ 86022

ATTN: Larry Casebolt

LGN: 344

QUALITY CONTROL DATA SHEET (cont'd)

QUALITY CONTROL STANDARDS (cont'd)

Parameter	Result	Certified Result	Acceptable Target Range	Relative Deviation From Mean	Spike % Recovery
Uranium	33	34	32 - 36	2.9%	---

Approved by D. Parker

EXHIBIT #2

HERMIT MINE PREMINING GROUNDWATER QUALITY
(Corrected 3/28/90)

HERMIT MINE GRW PREMINING BASELINE(AMENDED,03-90) 28-MAR-90 08:06:43 Pg 1

	A	B	C	D	E	F	G	H	I
1	PARAMETER,UNIT	HR 012	HR 019	HR 025	HR 032	HER 041	PREMINING	SAMPLE STANDARD	MAXIMUM ACCEPTABLE
2		04-28-88	06-29-88	09-29-88	12-23-88	05-31-89	SAMPLE MEAN	DEVIATION	VALUE
3									
4	As,mg/l	0.013	0.015	0.02	0.006	0.006	0.012	0.0060	0.0241
5	Ba,mg/l	0.01	0.02	0.04	0.04	0	0.022	0.0179	0.0578
6	Cd,mg/l	0	0.025	0	0	0	0.005	0.0112	0.0274
7	Cu,mg/l	0.01	0.02	0.02	0.04	0.02	0.022	0.0110	0.0439
8	Fe,mg/l	4.03	7.48	6.21	7.33	9.85	6.98	2.1157	11.2114
9	Pb,mg/l	0	0.15	0	0	0	0.03	0.0671	0.1642
10	Mn,mg/l	0.06	0.11	0.09	0.1	0.17	0.106	0.0404	0.1867
11	Hg,mg/l	0.0011	0.0011	0.0003	0	0.0002	0.00054	0.0005	0.0016
12	Se,mg/l	0.009	0	0.037	0.012	0.018	0.0152	0.0138	0.0428
13	Ag,mg/l	0.01	0.02	0.02	0	0	0.01	0.0100	0.0300
14	Zn,mg/l	0	0.118	0.07	0.136	0.015	0.0678	0.0603	0.1885
15	U,mg/l	0.0025	0.0025	0.0022	0.0024	0.0029	0.0025	0.0003	0.0030
16	Alk as CaC03,mg/l	159	155	157	157	159	157.4	1.6733	160.7466
17	HC03 as CaC03	159	155	157	157	159	157.4	1.6733	160.7466
18	C03,mg/l	0	0	0	0	0	0	0.0000	0.0000
19	Ca,mg/l	585	577	494	533	546	547	36.5718	620.1437
20	Cl,mg/l	43	41	42.3	40.1	39.6	41.2	1.4370	44.0740
21	Cr,mg/l	0.1	0.15	0.13	0.01	0.01	0.08	0.0663	0.2127
22	F,mg/l	1.47	1.39	1.32	1.41	1.26	1.37	0.0815	1.5331
23	Mg,mg/l	183	192	169	177	187	181.6	8.9331	199.4662
24	P04,mg/l	0	0	0	0	0	0	0.0000	0.0000
25	K,mg/l	25.3	24.4	19.4	21.6	25.7	23.28	2.6957	28.6715
26	Si02,mg/l	13.6	12.8	11	12.6	12.1	12.42	0.9602	14.3404
27	Na,mg/l	70.1	78.8	69.5	73.6	82	74.8	5.4649	85.7298
28	S04,mg/l	2230	2240	2080	2220	2360	2226	99.3982	2424.7964
29	TDS,mg/l	3500	3450	3430	3430	3470	3456	29.6648	3515.3296
30	N03 as N,mg/l	0.7	0	0	0	0	0.14	0.3130	0.7661
31	Gross alpha, pCi/l	0	0	76	12	14	20.4	31.7616	83.9232
32	Gross beta, pCi/l	31	27	38	30	39	33	5.2440	43.4881
33	Th230, pCi/l	0	0.7	0.4	0.6	0	0.34	0.3286	0.9973
34	Ra226,mg/l	3.5	2.6	0.4	2.1	1.2	1.96	1.2054	4.3708
35	Electrical conductiv	3430	3210	3340	3440	3200	3324	115.4556	3554.9112
36	umhos/cm								0.0000
37	pH,units	8.02		7.2	7.4	7.59	7.5525	0.3500	8.2525
38	TSS,mg/l	18		14	9	88	32.25	37.3486	106.9472

EXHIBIT 3
Premining Groundwater Inflow

Pumping Record
June, 1988 to May, 1989[1]

Month		GPM
June	1988	129,600
July	1988	432,000
August	1988	302,400
September	1988	446,400
October	1988	535,700
November	1988	505,440
December	1988	580,320
January	1989	631,656
February	1989	486,085
March	1989	522,946
April	1989	350,788
May	1989	526,910

(1) Pumping rates estimated using pump capacity and hours of operation for 1988. A totalizing flow meter was installed in January, 1989 and used thereafter.

EXHIBIT 4

A PORTION OF THE REPORT

"POTENTIAL IMPACTS OF MINING ON GROUND WATER RESOURCES"

PREPARED BY CANONIE ENVIRONMENTAL SERVICES

2.0 NATURAL FACTORS RESTRICTING MINE SEEPAGE MIGRATION

2.1 Physical Parameters

At the Hermit Mine site, physical parameters are the primary mechanisms that will restrict migration of seepage from the mine workings and shaft. These parameters include the following:

- o Permeability - Permeability, in particular vertical permeability, is the most important factor because it is the primary mechanism that will control the rate and distance seepage may migrate into the underlying strata.

- o Porosity - Porosity is a major factor which determines the magnitude of permeability and controls the amount of seepage that can be contained within the strata below the mine and shaft.

- o Specific Retention - Specific retention determines the amount of seepage that could be stored in the strata after the seepage has drained by gravity from the pores.

These parameters were evaluated by laboratory testing and field observation. Laboratory testing was conducted on core samples of Hermit Shale and of the breccia pipe from the Hermit deposit. The testing included air permeability, Klinkenberg permeability, porosity, and specific retention. The results of the laboratory testing are presented in Table 3 and a description of laboratory test procedures is presented in Appendix B.

Field observations included visits to two active mine sites and review of cores, geophysical, and lithological logs for the borings at the Hermit Mine site in May, 1987. The two mines visited were Kanab North and Pigeon. Figure 1 shows the location of these mines in relation to the Hermit Mine site.

2.1.1 Permeability

The permeability of the Hermit Shale and the breccia material was estimated in the laboratory using two procedures: air permeability and Klinkenberg permeability. The air permeability test is a common procedure used for evaluating rock samples. However, this provides an extremely conservative estimate of permeability. Actual liquid permeability would be lower than the calculated air permeability because of the higher viscosity of water compared to air. Since liquid permeability testing could not be conducted on the samples because the material was too impermeable to provide results, the Klinkenberg permeability test was conducted.

The Klinkenberg permeability test also utilizes a gas, but the results of the procedure, which measures the amount of gas slippage, correlate with given values of liquid permeability (Freeman and Bush, 1981, and Aronofsky, 1952). Even the Klinkenberg test may provide a conservative estimate of liquid permeability because the test does not account for chemical reactions between the rock and the liquid (Freeman and Bush, 1981). These reactions would further reduce the rate a fluid could migrate through a rock material. According to studies, the value of permeability using the Klinkenberg test may be 0.3 to 0.7 times higher than the actual liquid permeability (Freemand and Bush, 1981).

Field observations and laboratory data both show that the Hermit Shale and breccia pipe material are essentially impermeable. The strata exposed in the two operating mines (i.e., the Pigeon and Kanab North) was very tight and dry. As shown in Table 3, laboratory-determined air permeabilities for core samples of the breccia pipe were approximately 10^{-8} cm/sec and for the Hermit Shale were 10^{-9} cm/sec. These values are one to two orders of magnitude below the levels at which materials are commonly considered impermeable for hydrogeological and geotechnical engineering applications (Freeze and Cherry, 1979; Fetter, 1980; U.S. Dept. of Interior, 1981; Lambe and Whitman, 1969; Holtz and Kovacs, 1981; Sowers and Sowers, 1961). Furthermore, these values provide an extremely conservative estimate of

permeability since actual liquid permeability would be lower than calculated air permeability because of the higher viscosity of water compared to air.

The results of the Klinkenberg permeability testing, presented in Table 3, show that the estimated horizontal liquid permeability of the Hermit Shale was 10^{-10} cm/sec and the estimated vertical liquid permeability for the Hermit Shale were below the detection limit of the equipment, or at least 10^{-11} cm/sec. These estimated values may be lower depending on the effect of chemical reaction between the seepage and the rock. The vertical permeability is the most important value because it will control the rate of vertical migration of any liquids from the bottom of the mine and shaft. This value of vertical permeability is closer to the range of values determined in the laboratory for core samples from the Canyon Mine which averaged 8×10^{-11} cm/sec for Hermit Shale and 4×10^{-9} cm/sec for the breccia below the proposed depth of mining (Dames and Moore, 1987, after Core Lab).

An estimate of the distance seepage is predicted to migrate was made based on the laboratory-derived estimate of permeability and the rate and volume of inflow estimated from the data collected at the Pigeon Mine and trends reported for the Hack Canyon and Kanab North mines. The evaluation used both the overly conservative vertical gas permeability of 10^{-8} cm/sec and the more realistic Klinkenberg permeability value of 10^{-11} cm/sec to bracket the possible range of distances over which the seepage would be expected to migrate. The total volume of water (12 million gallons) available for seepage was estimated, based on inflows of ten gpm for one year and two gpm for six years.

Seepage migration was estimated using Darcy's law where the rate of migration is a function of the gradient and the permeability of the strata through which the fluid is migrating. Darcy's Law is the most commonly used expression for estimating fluid flow through porous material. Appendix C presents a description of the equations used.

The calculations indicate that using a vertical permeability of 10^{-11} cm/sec and 10^{-8} cm/sec, the seepage front could migrate a maximum distance of up to 0.07 feet below the shaft during the anticipated seven years of mine operation. These calculations provide a conservative estimate of the time and location of the seepage front because it was assumed that the following conditions will exist:

- All inflow to the mine will be ponded in the sump and will provide a constant source of water for seepage for the duration of operations. However, as demonstrated previously, the inflow to the mine and shaft is not expected to remain constant. Rather, it is expected to cease by the end of the operation.

- Both Darcy's Law and the vertical permeability value used are for saturated conditions. However, laboratory testing and visual observation indicated that the Hermit Shale was only partially saturated. Since the permeability of a partially saturated material increases with increasing water content (Freeze and Cherry, 1979, and Fetter, 1980), using the saturated permeability will result in higher infiltration rates and greater estimated distance for seepage migration than with an unsaturated permeability value.

After mining operations cease, all existing inflows to the shaft will be sealed with bentonite. Therefore, no additional inflow to the mine is expected. Since the source and driving head of seepage migration will be removed, further vertical migration of seepage will be due to gravity drainage of the seepage that has saturated less than one foot of the underlying strata.

However, if inflow to the mine or shaft continued after mining operations cease, the seepage would continue to migrate at a rate ranging from 0.2 feet per year (using a conservative permeability of 10^{-8} cm/sec) to 2 x 10^{-4} feet per year (using a more realistic permeability of 10^{-11}cm/sec). At these rates, and assuming a constant source of seepage, seepage could

migrate the 1,600 feet to the top of the Redwall-Muav aquifer in a period ranging from an overly conservative estimate of eight thousand years to a more realistic estimate of eight million years.

Fracture Permeability

Small-scale fracture permeability was evident in the two operating mines within the breccia pipe. During drilling and blasting operations, partially open fractures were intersected and water seeped out of the fractures at an estimated rate of less than 0.1 gpm. Apparently, the fractures are hydraulically discontinuous, and seepage from the fractures generally ceases within a period of a week or a month. No fracture permeability was identified in the Hermit Shale outside the pipes. Review of the geophysical and lithological logs and core from the Hermit Mine site indicated that this site will have similar small-scale fracture permeability to that seen in the two operating mines.

Large-scale fracture permeability resulting from faulting is not expected at the Hermit Mine site. Review of the logs and core as well as discussions with the exploration drilling operator provided no evidence of large-scale fracturing/faulting that could be a conduit for seepage migration from the mine to the Redwall-Muav aquifer. If a large-scale fracture/fault was present, it would have been identified during exploration drilling because of the dense spacing of boreholes at the site.

To evaluate the improbability of the presence of a large-scale fracture/fault at the site, a set of hypothetical faults was superimposed on existing site borehole information. The results of the evaluation show that only at two locations at the site are the borings spaced far enough apart that an almost vertical hypothetical fault or fracture would not be intersected by the borings. Figure 5 shows the locations of these two hypothetical features. Projection of a hypothetical fault/fracture plane from the ground surface traced along the alignment of Boring HU-536-025 (Fault A) and Boring HU-536-013 (Fault B) to the alignment of the bottom elevation of

the most distant boring (Boring HU-536-021 and Boring HU-536-011) indicates that two fault planes dipping at greater than 82° and 86° toward the southwest are the only features that would not be intersected by one of the exploration borings. Furthermore, these hypothetical faults would have to be oriented obliquely to the concentric fracture pattern within the breccia pipe structure evident from the surface geologic map presented on Figure 5.

Additional supporting evidence which indicates that there are no large-scale fractures or faults intersecting the site is the water level and water quality data obtained from the pumping test conducted at the site in February, 1987. As discussed in Section 1.4, water levels inside and outside the pipe showed a 100- to 200-foot difference in elevation, and concentrations of radionuclides were significantly higher inside as compared with outside the pipe. Also, as discussed in Section 1.3, there is no evidence of faulting in terms of deformation or offset of bedding that might be attributed to major fault displacement.

2.1.2 Porosity and Specific Retention

Porosity

The porosity of the Hermit Shale and the breccia material was estimated by laboratory testing. Table 3 shows the results of the testing and Appendix B presents the laboratory procedures. As expected, the Hermit Shale has a slightly lower porosity of five percent as compared to eight percent for the breccia material. These values are typical for impermeable shale and cemented rock materials (Freeze and Cherry, 1979; and Fetter, 1980).

Specific Retention

A percentage of the seepage which may saturate the strata below the mine and shaft will be retained in the pore spaces after gravity drains the free water. This water is held in the pore spaces of the rock by surface tension and is called specific retention. The sum of the specific retention

and the water that drains due to gravity is equal to the porosity. Specific retention increases with decreasing grain size because of the increased ratio of surface area to volume. Therefore, the specific retention of the Hermit Shale and the more silty portions of the breccia material are expected to be at least half of the total porosity (Fetter, 1980). An estimate of the specific retention of the Hermit Shale and the breccia material was made by conducting thermogravimetric analyses of core samples. The results are presented in Table 3 and the laboratory procedures are presented in Appendix B.

The results presented in Table 3 show that approximately 1.0 percent of the weight or 2.6 percent of the volume of the samples was pore water. Since the samples were visibly dry when tested, the water lost would represent water retained in the pores by specific retention. The actual value of specific retention is probably higher, but it is at least between three and eight percent of the total volume of the rock for the breccia and between three and five percent for the Hermit Shale. For the purpose of this evaluation, the specific retention was assumed to be half of the pore space that was not already filled with water or one percent of the total pore volume.

Estimated migration of seepage after mining operations cease was calculated using a one-dimensional piston flow model assuming that all the water estimated to saturate up to 0.07 feet of shale below the shaft during mining would drain except that held by specific retention. The water that drains would then continue to migrate until the pore volume equal to the specific retention of the underlying unsaturated shale had been filled. At this point, further gravity drainage would cease. The results of the evaluation indicated that the seepage would migrate no more than an additional 0.07 feet.

In summary, the distance seepage is predicted to migrate beneath the sump during the seven years of mining operations is up to 0.07 feet, plus up to an additional 0.07 feet due to gravity drainage after mining operations

cease for a total maximum migration distance of less than 1.0 foot. If inflow to the mine were to remain constant after mining operations cease, the seepage could continue to migrate below the sump and mine. However, using the most realistic estimate of permeability of 10^{-11}cm/sec, the rate of migration is estimated to be 2×10^{-4} feet per year. Therefore, the seepage front would reach the Redwall-Muav aquifer in approximately eight million years. Even using the overly conservative permeability of 10^{-8} cm/sec, the seepage front would not reach the Redwall-Mauv aquifer for at least eight thousand years.

TABLE 3

SUMMARY OF PHYSICAL PROPERTIES OF SAMPLES FROM
BRECCIA PIPE AND HERMIT SHALE

SAMPLE LOCATION	BORING 023	BORING 023	HER-CH-001	HER-CH-001
	BRECCIA/1389'	BRECCIA/1389'	HERMIT/1000'	HERMIT/1000'
SAMPLE ORIENTATION	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL
TEST METHOD				
PERMEABILITY TO AIR (md)	0.08	0.02	<0.01	<0.01
PERMEABILITY TO AIR (cm/s) (1)	8.0E-08	2.0E-08	<1.0E-08	<1.0E-08
POROSITY (%)	8.9	8.1	5.6	5.4
PERMEABILITY (md) (2)	(3)	(3)	0.00021	(4)
PERMEABILITY (cm/s) (1,2)	(3)	(3)	2.0E-10	-
(DETERMINED BY KLINKENBERG ANALYSIS)				
WATER CONTENT BY WEIGHT (%)	1	-	1	-
WATER CONTENT BY VOLUME (%)	2.6		2.6	
(DETERMINED BY THERMOGRAVIMETRIC ANALYSIS)				

(1) Conversion from milidarcies to cm/s, 1 md = 9.66E-07 cm/s.
(2) Tested using equivalent overburden pressure of 1000 psi.
(3) Sample disintegrated when tested.
(4) Permeability below detection limit of equipment.

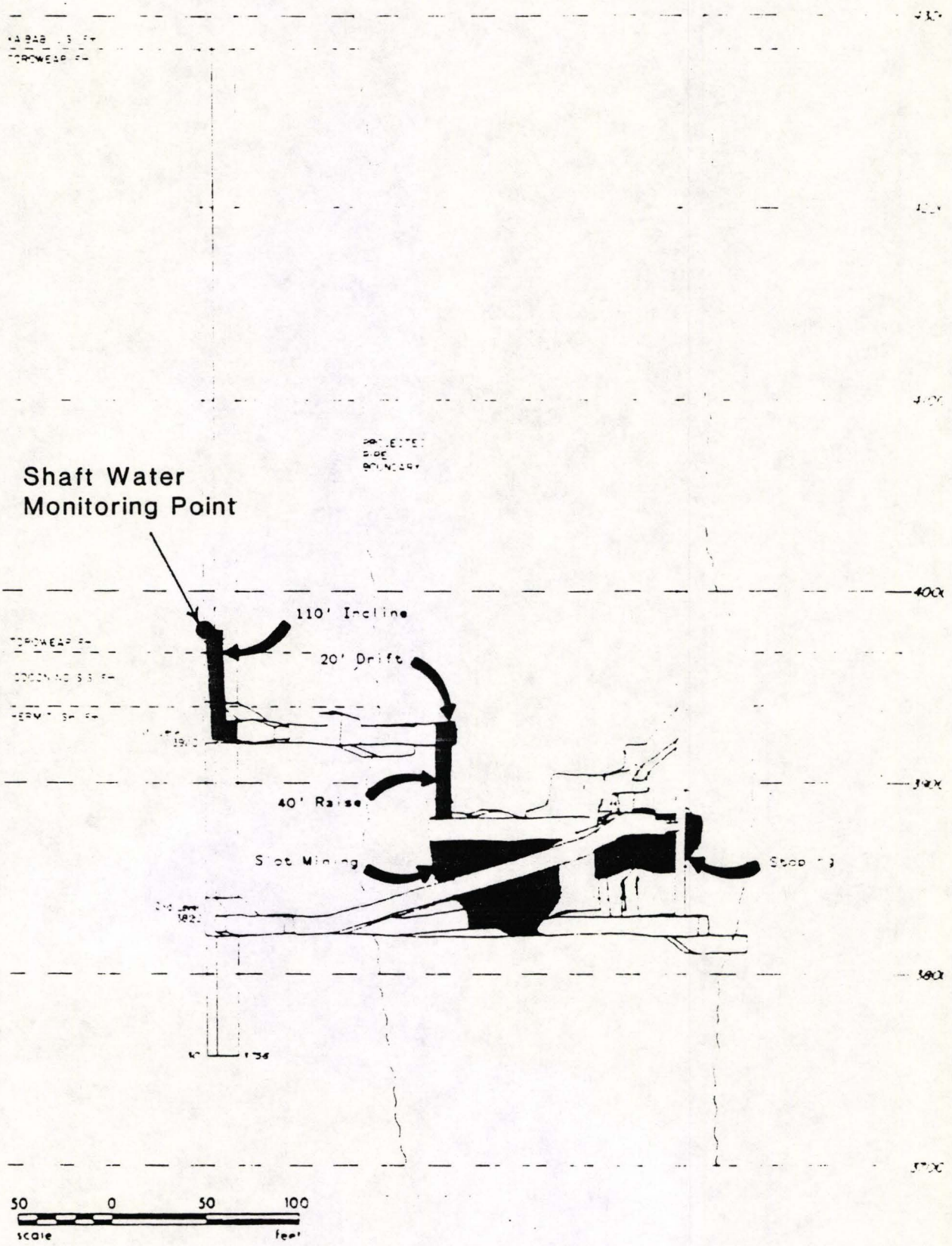


Plate # 1

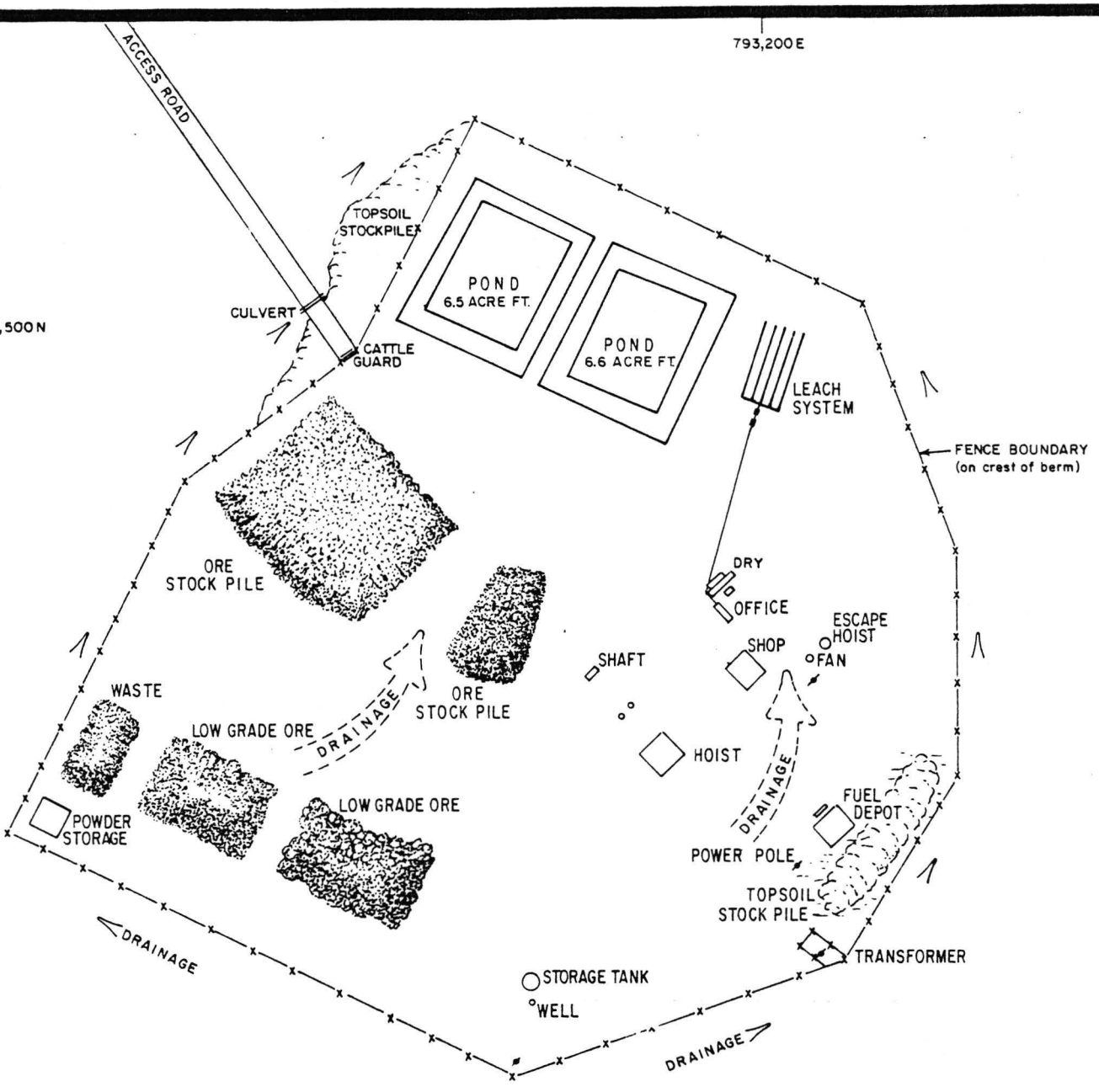
energy fuels nuclear, inc.

PROJECT

TITLE HERMIT SHAFT WATER MONITOR POINTS (3976'MSL)

SCALE | DWG. NO. | REV 2/90

120786



energy fuels nuclear, inc.

Project:	HERMIT
REVISION Date / By	County: MOHAVE; State: ARIZONA
	Location: T N, R W
	Title: HERMIT SURFACE LAYOUT
	Scale: 1" = 200'; Date: 9-8-89; Draftsman: J D M
	Author: D. PILLMORE; Map No.

Plate #2

Miguel S. Santiago

Summary of Monitoring Results
Hermit Mine Monitor Well

(mg/l)	4/28/88	6/28/88	9/27/88 (well)	9/27/88 (shaft)
Alkalinity as CaCO3	159	155	157	235
HCO3 as CaCO3	159	155	157	235
CO3 as CaCO3	<1	<1	<1	<1
NH4(N)	<.1		<.1	<.1
As	.013	.015	.020	.045
B			.38	
Ba	.01	.02	.04	.02
Cd	<.005	.025	<.005	<.005
Ca	585	577	494	570
Cl	43	41	42.3	30.1
Cr	.10	.15	.13	.09
Condt. (umho/cm)	3430	3210	3340	3350
Cu	.01	.02	.02	.019
F	1.47	1.39	1.32	1.16
Fe	4.03	7.48	6.21	.62
Pb	<.02	0.15	<.02	<.02
Mg	183	192	169	172
Mn	.06	.11	.09	.04
Hg	.0011	.0011	.0003	.0005
Mo			.05	
NO3(N)	.7	<.1	<.1	

pH (units)	8.02	6.54	7.2	7.2
PO4	<.1	<.01	<.1	<.1
K	25.3	24.4	19.4	25.1
Se	.009	.006	.037	.017
SiO2	13.6	12.8	11.0	10.3
Ag	.01	.02	.02	.02
Na	70.1	78.8	69.5	76.1
TDS	3500	3450	3430	3250
TSS	18		14	<4
SO4	2230	2240	2080	2040
SO3			<2	
Zn	<.005	.118	.070	.070
Alpha(pCi/l)	0±19	0±16	76±25	1300±100
Beta "	31±12	27±10	38±11	490±20
Ra-226 "	3.5±0.7	2.6±0.6	0.4±0.2	150±10
Ra-228 "	0.0±0.7			
Th-230 "	0.0±0.3	0.7±0.7	0.4±0.4	1.2±0.8
Pb-210 "	0.5±0.9			
Po-210 "	0.8±0.5			
U(mg/l)	0.0025	0.0025	.0022	.0420

Is only 1,000 in septic water which draws from R/M and in 1989 well sampling see page 1,184

How can alpha be 0 and beta 31 & 27?

energy fuels nuclear, inc.

one tabor center • suite 2500
1200 seventeenth street • denver, colorado 80202

(303) 623-8317
twx 910-931-2561

June 10, 1987



Ms. Carol Russell
Water Permits Unit
Arizona Department of Health Services
State Health Building
1740 West Adams Street
Phoenix, Arizona 85007

Re: Notice of Disposal Form - Hermit Mine

Dear Ms. Russell:

Please find enclosed the completed Notice of Disposal form and enclosures for the Hermit mine located in Mohave County, Arizona. Please note that the Hermit mine has been designated as a new facility for your permitting process.

If you have any questions or require additional information, please feel free to contact me.

Very truly yours,

W. J. Almas
Environmental Engineer

WJA:smm

Enclosure

cc: M. D. Vincelette, Energy Fuels
B. L. Doores, Energy Fuels
R. B. Smith, Energy Fuels
H. R. Roberts, Energy Fuels
R. D. Hembree, Energy Fuels



NOTICE OF DISPOSAL FORM

1) a. FACILITY NAME: Hermit Mine

b. FACILITY OWNER: Energy Fuels Nuclear, Inc.

c. NAME, TITLE, ADDRESS, AND TELEPHONE NUMBER OF CONTACT PERSON FOR FACILITY:

NAME: William J. Almas

TITLE: Environmental Coordinator

MAILING ADDRESS: One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, Colorado 80202

TELEPHONE NUMBER: (303) 623-8317

d. ADDRESS AND TELEPHONE NUMBER OF FACILITY:

MAILING ADDRESS: Energy Fuels Nuclear, Inc.
P. O. Box 36
Fredonia, Arizona 86022

TELEPHONE NUMBER: (602) 643-7321

e. FACILITY LOCATION INFORMATION:

Twenty-one miles southwest of Fredonia, Arizona

Mohave County, Arizona

Township 38 West T38N OR T39N

Range 4 West

Section 17 W 1/2 SW 1/4

f. DESCRIBE ACCESS TO FACILITY:

From Fredonia, Arizona take Highway 389, 8.5 miles to Mt. Trumball Road; 14.2 miles south on Mt. Trumball Road to site access road and southeast 1.5 miles to project site.

g. LANDOWNER OF FACILITY SITE:

U. S. Bureau of Land Management

h. TYPE OF PERMIT YOU ARE APPLYING FOR:

AREA PERMIT_____ INDIVIDUAL FACILITY PERMIT_X_

i. TYPE OF FACILITY REQUESTING PERMIT:

NEW__X__ EXISTING_____

2. a. ATTACH A TOPOGRAPHIC MAP (PREFERABLY A 7.5 MINUTE QUADRANGLE BASE), SHOWING THE GEOGRAPHIC LOCATION OF THE FACILITY(S) AND ALL DISPOSAL LOCATIONS. IN ADDITION, SHOW THE LOCATION OF ANY EXISTING GROUND-WATER WITHDRAWAL WELLS WITHIN THE APPROXIMATE VICINITY (1/4 MILE RADIUS) OF THE DISPOSAL AREA AND IDENTIFY THE USE OF EACH WELL (I.E. INDUSTRIAL WELLS, DRINKING WATER SUPPLY WELLS, ETC.). (IF APPLYING FOR AN AREA PERMIT AS DESCRIBED IN R9-20-211, INDICATE ON THE MAP THE LOCATION OF EACH FACILITY AND DISPOSAL LOCATION IN THE PROPOSED PERMITTED AREA).

Refer to Plates 1 and 2 of the "Plan of Operations" for location of the facility. The only known ground-water well within 1/4 mile of the facility is located within the operations area of the proposed mine. The well was an exploration borehole which was completed as a stock well when water was encountered. The well is located near the Hermit breccia pipe, but not within it. This well was drilled and completed by Energy Fuels Nuclear in August, 1982. The well has a piston pump installed at the 480 foot level. The source of this water appears to be the saturated zone existing in the Toroweap limestone. The well produces approximately 2 gpm on an intermittant basis, and presently supplies a stock watering tank. The well has the registration number 55-503919.

Upon commencement of site preparation and shaft sinking operations, use of the well will be discontinued, the stock watering tank removed and the well capped and abandoned.

b. LIST LATITUDE/LONGITUDE OF ALL DISPOSAL LOCATIONS INDICATED ON THE ATTACHED MAP:

LATITUDE: 112° 45' 04" N

LONGITUDE: 36° 41' 23" W

3. a. TYPE OF FACILITY(s): Underground uranium mine

b. NATURE OF ACTIVITY CONDUCTED AT FACILITY(s):

Production of uranium ore from the underground mine.

c. DESCRIBE EXISTING GROUND WATER USE(s) OF THE RECEIVING AQUIFER(s):

Based upon extensive drilling and interpretation of geologic log information, two locally saturated zones are thought to exist between the ground surface and the base of mine workings. The Redwall-Mauv Formation is approximately 1,000 feet below the lowest extent of mine workings and is the only known regional aquifer in the vicinity of the proposed mine workings. Refer to Section 3.3.2 of the Dames & Moore "Ground-Water Conditions" report for further details.

A water supply well will be completed at the time surface site preparation commences. The water supply well to be drilled at the Hermit site has been assigned the registration number of 55-517832. The well will be constructed in the following manner: the surface casing will consist of twenty-two feet of 11 3/4 inch steel casing grouted in place in a 14 3/4 inch diameter hole. A 10 5/8 inch bit will then be used to deepen the hole to a depth of 975 feet or 40 feet into the Hermit shale. This portion of the hole will be cased with 976 feet of 8 5/8 inch steel casing. A 7 7/8 inch bit will then be used to deepen the hole to an estimated total depth of 2,800 feet, or approximately 100 feet into the Redwall limestone aquifer. The water production anticipated from this aquifer is expected to range from 5 to 15 gallons per minute. The formations and their respective thicknesses, which will be penetrated by the well are, in descending order: Moenkopi-260 feet, Kaibab Limestone Formation-342 feet, Toroweap Formation-311 feet, Coconino Sandstone-29 feet, Hermit Shale-650 feet, Supai Group-1,100 feet and Redwall Limestone-100 feet.

d. LIST APPLICABLE U. S. DEPARTMENT OF COMMERCE STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODES FOR ABOVE ACTIVITIES:

Division B 1094

4. DATE FACILITY BEGAN/WILL BEGIN OPERATING: June, 1987

Site work is proposed to commence in June of 1987. Shaft sinking will commence in October, 1987. Ground water is anticipated to be encountered March 1, 1988.

5. EXPECTED FACILITY(s) OPERATIONAL LIFETIME: Through 1997

6. LIST ANY OTHER ENVIRONMENTAL PERMITS ISSUED TO THE FACILITY(s) (I.E. AIR QUALITY PERMIT, NPDES PERMIT, HAZARDOUS WASTE PERMIT)

Request for Approval to Construct an Underground Uranium Mine will be made to the U. S. Environmental Protection Agency (EPA) pursuant to 40 CFR Part 61.

7. a. DESCRIBE DISPOSAL ACTIVITIES AT THE FACILITY(s):

Mine water and surface runoff from the operations area will be collected in lined surface impoundments. Refer to the attached "Plan of Operations", February, 1987 for a more detailed description of activities through the life of mine.

b. DESCRIBE ANY CONTROL MEASURES AND TREATMENT PROCESSES DESIGNED AND OPERATED TO PROTECT GROUND-WATER QUALITY FROM EFFECTS OF THE DISPOSAL:

The surface impoundments will be lined with 36 mil hypolon. The impoundments will be designed to hold the volume of runoff from the operations resulting from at least the 100-year/24-hour event, water pumped from the mine and a five-year storage volume for sediment. Refer to the attached Dames & Moore "Hydrologic Evaluations for the Proposed Hermit Uranium Mine", February 1987.

A water supply well will be completed at the time surface site preparation commences. This well will be completed in the Redwall-Mauv limestone. The Redwall-Mauv is approximately 1,000 feet below the lowest extent of mine workings and is the only known regional aquifer in the vicinity of the proposed mine workings.

c. NOTE OF DEPTH TO GROUND WATER:

DATE OF MEASUREMENT:

The stock watering well previously mentioned in Section 2a above was completed by Energy Fuels Nuclear as an exploration borehole on August 5, 1982. The borehole has a total depth of 690 feet. The borehole penetrates the Moenkopi, Kaibab and Toroweap Formations and is located outside the breccia pipe. Based upon drill log interpretation and observation during drilling, a local saturated zone apparently exists within the Toroweap at a depth of 602 to 680 feet below ground surface.

Static water level within the borehole, however, was approximately 360 feet below the surface at the time of borehole completion. The piston pump used for stock watering is installed at a depth of 480 feet below the surface.

A second saturated zone outside the breccia pipe apparently exists at the contact between the Coconino Sandstone and Hermit Shale. Static water levels within selected exploration boreholes in the Hermit were between 767 and 607 feet during investigations carried out in February of 1987 by Energy Fuels Nuclear.

d. ENTER IN APPENDIX A - PART I THE AMBIENT GROUND-WATER CONCENTRATIONS OF THE RECEIVING AQUIFER(s) FOR THOSE CONSTITUENTS LISTED THAT ARE CONTAINED IN THE DISPOSAL. INDICATE SOURCE OF DATA AND DATE OF SAMPLING FOR ALL VALUES LISTED.

The Redwall-Mauv formation is the only known aquifer in the vicinity of the proposed mine. The water supply well has not yet been drilled so no analytical results are available. Refer to Section 3.4, Ground-Water Quality of the attached Dames & Moore "Ground-Water Conditions" report for a comparison of water quality in wells associated with other Energy Fuels operations on the Arizona Strip. The Hunt #5 well referenced in Table 2 of this report is the stock well discussed in Section 7 above.

Also attached as Exhibits #1 and #2 are water quality analysis from boreholes HU 536-034 and HU 536-031 located within the vicinity of the proposed Hermit mine.

HU 536-024 is located inside the breccia pipe (object of mining) and HU 536-031 is located outside the breccia pipe. It should be noted that the water quality within the pipe varies significantly from the water quality outside the pipe. Ground-water samples were collected on February 12, 1987 and February 24, 1987 respectively, and were sampled and preserved according to appropriate EPA guidance.

8. a. IDENTIFY THE TYPE(s) OF WASTE(s) GENERATED BY EACH PROCESS WITHIN THE FACILITY. BE AS DESCRIPTIVE AS POSSIBLE WITHOUT LISTING SPECIFIC CONSTITUENTS:

No discharge to surface or ground water will occur. Water will be intermittently pumped from underground workings to one or more lined surface impoundments, where it will be allowed to evaporate or be reused in connection with mining activities. The water will consist of unaltered ground water and surface runoff. No chemical processing of ore will occur on-site.

b. CHECK OF LIST IN APPENDIX A - PART II OF THE SPECIFIC POLLUTANTS DISPOSED BY THE FACILITY. INCLUDE THOSE DISPOSED MATERIALS THAT ARE LISTED IN TABLES I AND II OF THIS DOCUMENT IN TITLE 40 CODE OF FEDERAL REGULATIONS PART 261, OR ANY OTHER CONSTITUENT CONTAINED IN THE DISPOSED WASTE STREAM.

N/A - Unaltered ground water containing some suspended material.

c. ENTER IN APPENDIX A - PART II THE MAXIMUM DISPOSAL CONCENTRATION OF THOSE CONSTITUENTS YOU CHECKED OR LISTED, AS REQUIRED BY 8b. INDICATE THE DATE OF SAMPLING IN PARENTHESIS NEXT TO THE SAMPLE VALUE AND THE SOURCE OF THE DATA AT THE BOTTOM OF PAGE THREE IN APPENDIX A.

N/A - Unaltered ground water containing some suspended material.

d. ESTIMATE THE DISPOSAL SCHEDULE INCLUDING THE ANNUAL AVERAGE IN HOURS PER DAY, DAYS PER YEAR, AND THE DISPOSAL PERIODS IF THE DISPOSAL IS SEASONAL.

HOURS/DAY: No discharge

DAYS/YEAR: N/A

SEASONAL DISTRIBUTION OF DISPOSAL: N/A

e. ESTIMATE THE FLOW RATE(s) OF THE DISPOSAL (I.E. MINIMUM, AVERAGE, AND MAXIMUM DAILY FLOW; MEAN ANNUAL FLOW; OR MEAN, MINIMUM, AND MAXIMUM FLOW BY SEASON IF DISPOSAL IS PERIODIC; OR BY WHATEVER OTHER UNITS APPROPRIATE TO THE TYPE OF DISPOSAL:

N/A

9. DESCRIBE ANY EXISTING GROUND-WATER QUALITY MONITORING PROGRAM(s) (ATTACHED SUPPORTING TECHNICAL REPORTS IF AVAILABLE):

There is no ongoing monitoring program. Ambient water quality analysis for two boreholes are attached. Water quality for the existing stock well located on-site is presented in the Dames & Moore "Ground Water Conditions" report as Hunt #5, along with a discussion of ground-water quality.

10. INCLUDE ANY OTHER DATA OR INFORMATION WHICH, IN THE JUDGMENT OF THE OWNER/OPERATOR, DEMONSTRATES THAT THE FACILITY QUALIFIES FOR A GROUND-WATER QUALITY PROTECTION PERMIT BASED ON COMPLIANCE WITH THE CRITERIA LISTED IN 49-20-208.A. USE ATTACHMENTS IF APPLICABLE (I.E. DEPTH TO GROUND WATER, GEOLOGY AT THE SITE).

11. CERTIFICATION:

"I CERTIFY THAT UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED IN THIS DOCUMENT AND ALL ATTACHMENTS AND THAT, BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THAT THE INFORMATION IS TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT."

MURIL D. VINCELETTE
Printed Name of Applicant

VICE PRESIDENT, OPERATIONS
Title

JUNE 10, 1987
Date Application Signed

Signature of Applicant



ADHS/BWWQM-218 (1/84)
Revised 7/84

EXHIBIT #1

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 277-1687

1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

nergy Fuels Nuclear, Inc.
ne Tabor Center, Suite 2500
1200 Seventeenth Street
enver, CO 80202

ATTN: William J. Almas

lient No. Log No. 6539 Client PO No.

Sample Type: water

ate Collected: 2/12/87 Date Received: 2/16/87 Date Reported: 3/31/87

Sample Identification	As mg/l	Ba mg/l	Cd mg/l	Ca mg/l	Cr mg/l
ermitt HU 536-024	0.008	<0.1	0.002	544	0.02

inside breccia pipe

Cu mg/l	Fe mg/l	Pb mg/l	Mg mg/l	Mn mg/l
0.02	22.7	0.008	219	0.72

Text

Hg mg/l	Mo mg/l	K mg/l	Ag mg/l	Se mg/l
<0.0002	0.2	46.2	0.01	0.002

Na mg/l	Zn mg/l	CO_3 as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	B mg/l
236	0.475	<1	222	0.63

Cl mg/l	CN mg/l	F mg/l	NO_3 as N mg/l	pH units
127	<0.001	1.68	<0.01	7.22

Approved by

BARRINGER LABORATORIES INC.

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GOLDEN, COLORADO 80401
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1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

ATTN: William J. Almas

LGN: 6539

Sample Identification	SO_4 mg/l	TDS mg/l	TSS mg/l	Specific Conductance µmho/cm
Hermitt HU 536-024	2300	4120	87	3950

Phenols mg/l	Turbidity JTU	NH_4 as N mg/l	S mg/l	U Dissolved mg/l
<0.01	2	0.4	<0.1	0.264

U Suspended mg/l	Gross Alpha pCi/l ±Precision*	Gross Beta pCi/l ±Precision*	Th 230 pCi/l ±Precision*
0.0106	750 ± 70	390 ± 20	1.3 ± 0.9

Ra 226 pCi/l ±Precision*	Pb 210 pCi/l ±Precision*	Po 210 pCi/l ±Precision*	Ra 228 pCi/l ±Precision*
300 ± 10	104 ± 2	5.9 ± 1.1	1.5 ± 1.0

* Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 2σ

Approved by _____

EXHIBIT #2

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300
GOLDEN, COLORADO 80401
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1455 DEMING WAY, SUITE 15
SPARKS, NEVADA 89431
PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

ATTN: William J. Almas

Client No. Log No. 6568 Client PO No.

Sample Type: water

Date Collected: Date Received: 2/27/87 Date Reported: 3/31/87

Sample Identification	As mg/l	Ba mg/l	Cd mg/l	Ca mg/l	Cr mg/l
Hermit HU 536-031 #1	0.004	<0.1	0.001	547	0.02

outside of pipe

Cu mg/l	Fe mg/l	Pb mg/l	Mg mg/l	Mn mg/l
0.01	29.0	0.002	185	0.74

Hg mg/l	Mo mg/l	K mg/l	Se mg/l	Ag mg/l
<0.0002	<0.1	23.7	0.002	0.01

Na mg/l	Zn mg/l	CO_3 as $CaCO_3$ mg/l	HCO_3 as $CaCO_3$ mg/l	B mg/l
67.4	0.131	<1	40	0.46

Cl mg/l	Specific Conductance µmho/cm	CN mg/l	F mg/l	NO_3 as N mg/l
26	4180	<0.001	1.47	0.13

Approved by

ADVANCED TECHNIQUES AND INSTRUMENTATION FOR THE EARTH SCIENCES

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PHONE: (702) 358-1158

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

ATTN: Bill Almas

LGN: 6568

Sample Identification	pH units	TDS mg/l	TSS mg/l	SO_4 mg/l	S mg/l
Hermit HU 536-031 #1	7.43	3350	84	2140	<1

Phenols mg/l	Turbidity JTU	NH_4 as N mg/l	U Dissolved mg/l	U Suspended mg/l
<0.01	2	0.30	0.0215	0.0031

Gross Alpha pCi/l ±Precision*	Gross Beta pCi/l ±Precision*	Th 230 pCi/l ±Precision*	Ra 226 pCi/l ±Precision*
230 ± 30	92 ± 13	0.4 ± 1.2	53 ± 2

Pb 210 pCi/l ±Precision*	Po 210 pCi/l ±Precision*	Ra 228 pCi/l ±Precision*
6.5 ± 2.1	0.2 ± 0.6	0.8 ± 0.9

* Variability of the radioactive disinegration process (counting error) at the 95% confidence level, 2σ

Approved by

File Divider Page

Final
WJA

HERMIT MINE 100299
GROUND-WATER CONDITIONS
MOHAVE COUNTY, ARIZONA
FOR
ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

Dames & Moore

Prepared By:

DAMES & MOORE
1626 Cole Boulevard
Golden, Colorado 80401
(303) 232-6262
March 20, 1987

Dames & Moore

1626 Cole Boulevard
Golden, Colorado 80401
(303) 232-6262
TELEX: 3720401 Cable Address: DAMEMORE

March 20, 1987

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200-17th Street
Denver, Colorado 80202

Attention: Mr. William J. Almas

Re: **Hermit Mine**
Ground-Water Conditions
Mohave County, Arizona

Gentlemen:

We are pleased to submit our report on Ground-Water Conditions at the Hermit Mine.

We would be pleased to discuss the report with you and to respond to any questions or comments you may have.

Very truly yours,

DAMES & MOORE

Richard L. Harlan djb

Richard L. Harlan
Associate/Senior Hydrogeologist

RLH:djb

Enclosures

HERMIT MINE

GROUND-WATER CONDITIONS

MOHAVE COUNTY, ARIZONA

Prepared For:

ENERGY FUELS NUCLEAR, INC.

Denver, Colorado

By:

DAMES & MOORE

Golden, Colorado

March 20, 1987

Dames & Moore

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SUMMARY AND CONCLUSIONS

The Hermit Mine is a proposed underground uranium mine, located approximately 22 miles south-southwest of the town of Fredonia in Mohave County, Arizona. The mineralized zone to be mined is within a collapse breccia pipe which will be accessed by a 1,100 foot vertical shaft to be located outside the ore body, and by extending horizontal drifts into the ore body.

The mine site is located on the Kanab Plateau which is part of the Grand Canyon section of the Colorado Plateau physiographic province. This section of the Colorado Plateau is characterized by flat to gently-sloping plateaus and mesas abruptly dissected by deep canyons. Geologically, the region as a whole is characterized by a thick sequence of flat to gently-dipping sedimentary rocks. In the Grand Canyon area, the sedimentary sequence ranges from about 3,500 to 4,500 feet thick and overlies highly-deformed Precambrian sedimentary, metamorphic, and igneous rocks.

Throughout much of the Colorado Plateau, the regional ground-water table is deep and controlled largely by the elevation of the Colorado River and its major tributaries which are deeply incised. In the vicinity of the Hermit Mine, the regional water table is at a depth greater than 2,000 feet and approximately 1,000 feet below the proposed depth of mining.

Perched ground-water conditions occur locally within the sedimentary sequence above the regional water table. These perched aquifers, however, are typically discontinuous and frequently not capable of being produced on a sustained-yield basis due to the low rates of natural ground-water recharge and their limited lateral extent.

At the Hermit Mine site, perched ground-water conditions have been identified during exploratory drilling within the Coconino sandstone immediately above its contact with the underlying Hermit shale and within the Toroweap limestone. Other perched ground-water zones also may be anticipated to occur as isolated or discontinuous lenses within the Toroweap and Kaibab limestones. These perched zones may yield small quantities of water to the mine workings as they are penetrated. The experience at the Hack Canyon and Pigeon Mines, which are located in the same general area, has been that rates of ground-water inflow to the mine workings decrease with time and generally cease within a period of several months. Parametric studies have further shown that based on the observed rates of ground-water inflow at the Hack Canyon and Pigeon Mines, the "effective" radius of influence as a result of drainage into the mine workings will be small and is typically less than a few thousand feet.

The mine plan for the Hermit Mine calls for extraction of uranium ore from an approximate 600-foot vertical zone within the breccia pipe. The final depth of mining, however, will be nearly 1,000 feet above the regional ground-water table which is within the Redwall-Muav limestone aquifer. The Redwall-Muav aquifer is the upper-most aquifer of regional

importance capable of providing a continuous water supply of even a few gallons per minute. Following cessation of mining, the rate of ground-water inflow to the mine workings will depend on the hydraulic transmission and storage characteristics of the overlying strata and the rate of natural ground-water recharge. As the mine working will be above the regional ground-water table, continued inflow and partial filling of the mine would result in a potential for downward percolation and recharge to the underlying strata and the Redwall-Muav aquifer system. Although a potential exists for downward water migration, the likelihood of significant downward flow is extremely small due to the extensive and complete recementation of the breccia pipe during and following mineralization. Visual observations within both the Hack Canyon and Pigeon Mines have shown the absence of open fractures or joints within the pipe and that essentially all of the voids within the rubblized collapse zone have been filled with a fine-grained matrix comprised mainly of carbonaceous materials. As a result, the breccia pipe and the area immediately surrounding the pipe are effectively impermeable. This has been confirmed by laboratory tests on core samples from the Canyon Mine prospect. Laboratory tests on rock core samples from the breccia pipe at the Canyon Mine prospect, which is located on the South Rim of the Grand Canyon, indicates that the hydraulic conductivities of the rock mass within and adjacent to the pipe is less than 1×10^{-8} cm/sec. This is consistent with observed conditions in operating mines on the North Rim, specifically the Hack Canyon and Pigeon Mines.

Because of the physical separation between the bottom of the mine and the regional water-table and the potential ameliorating effects of the intervening argillaceous strata, no measurable effects on ground-water quality or quantity are expected to occur as a result of the mining activities.

1.0 INTRODUCTION

The Hermit Mine is a proposed underground uranium mine. The ore deposit is located within a breccia pipe which was located in 1985 and confirmed by exploratory drilling by Energy Fuels Nuclear, Inc. (EFN) . The site is located on unpatented lode mining claims, approximately 22 miles south-southwest of the town of Fredonia in Mohave County, Arizona (Section 17, Township 39 North, Range 4 West, Gila and Salt River Meridian).

In this report, existing geologic and ground-water conditions in the Hermit Mine area are addressed. A discussion is also presented on the hydrogeological characteristics of other breccia pipe mines in the general vicinity and the potential hydrogeological impacts as a result of the proposed mining activities.

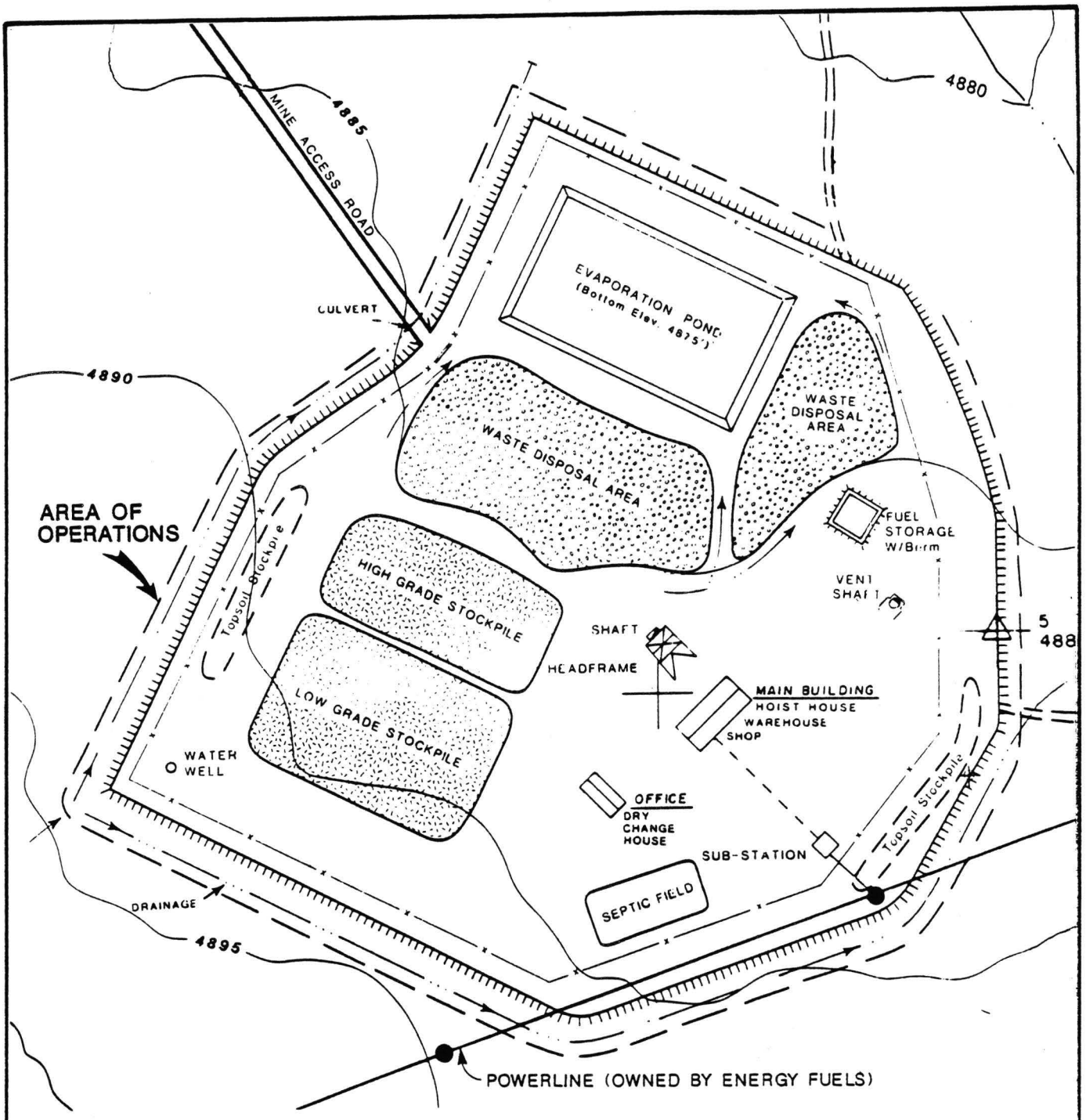
2.0 PROJECT DESCRIPTION

The Hermit Deposit is a uranium ore deposit located within and immediately adjacent to a collapse breccia pipe. The deposit will be mined by sinking a vertical shaft approximately 1,100 feet below the existing ground surface. The shaft will be located adjacent to but outside of the zone of mineralization. The deposit will be mined by extending horizontal drifts into the ore body and mining out the mineralized core of the breccia pipe.

Surface facilities at the mine site will include the headframe, combined hoist, compressor, warehouse and maintenance building and office/mine dry facility. A one-and-a-half mile access road will be constructed to connect the mine site with the existing Mount Trumbull Road. The proposed physical layout of the surface facilities at the Hermit Mine site is shown on Figure 1.

The uranium ore produced by the mine will be temporarily stored in a lined area at the mine site and trucked to an existing mill at Blanding, Utah. No ore processing will be carried out at the mine site.

Plans call for the completion of a water well into the Redwall-Muav aquifer to supply the water requirements for both mining operations and sanitary purposes. The proposed depth of the water-supply well to be located onsite is 2,800 to 3,000 feet.



Facility Layout Hermit Mine Site

Dames & Moore

Figure 1

3.0 HYDROGEOLOGICAL SETTING

3.1 Location, Physiography, and Climate

The Hermit Mine is situated on the Kanab Plateau which is part of the so-called "Arizona Strip". The Arizona Strip includes that portion of northwestern Arizona north and west of the Grand Canyon and the Colorado River, including the North Rim of the Grand Canyon.

The Grand Canyon of the Colorado River lies within the Colorado Plateau physiographic province. The Colorado Plateau extends over an area of some 130,000 square miles including all of the Arizona Strip. The Grand Canyon section of the Colorado Plateau is characterized by flat to gently-sloping plateaus and mesas abruptly dissected by deep canyons. Geologically, the region as a whole is characterized by a thick sequence of flat to gently-dipping sedimentary rocks. The mine site itself is flat to gently sloping with maximum relief in the area on the order of 80 feet.

The Hermit Mine site is located near the headwaters of Bulrush Canyon. Bulrush Canyon is a tributary to Kanab Creek which in turn is a tributary to the Colorado River. Kanab Creek has the lowest yield per unit area of the tributaries to the Colorado River in the Grand Canyon area with no measurable flow for several months of each year at its confluence with Bulrush Creek.

Vegetation within the Hermit Mine area consists mainly of grasses and sagebrush. Typically the density of the vegetative cover is less than about 50 percent.

The regional climate is semi-arid to arid and is continental, typified by cool winters and warm summers, and light precipitation (less than 15 inches per year).

Precipitation in the Grand Canyon area is dependent on elevation and geographic location. Elevational effects can be illustrated by comparing the mean annual precipitation on the South Rim, at Phantom Ranch, and on the North Rim (Table 1). These three locations lie roughly on a straight line, approximately 13 miles long. For the period 1951 to 1980, the South Rim at elevation 6,970 feet received an average annual rainfall of 14.6 inches; Phantom Ranch at 2,570 feet received an average of only 8.7 inches, and the North Rim at 8,400 feet received 25.5 inches. The importance of geographic location is illustrated by comparing average annual precipitation on the South Rim and at Desert View, 18 miles to the east. For the 21-year period 1961 to 1982, the South Rim averaged 15.5 inches annually compared to Desert View which is on the same plateau, which received an average of 13.0 inches.

TABLE 1

AVERAGE MONTHLY PRECIPITATION AT GRAND CANYON AREA LOCATIONS

	Elevation (ft)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
South Rim[1]	6,785	1.49	1.26	1.61	0.92	0.62	0.58	1.49	1.96	1.07	1.20	1.01	1.45	14.65
Desert View[2]	7,400	1.16	1.08	1.54	0.75	0.71	0.28	1.29	1.53	1.04	1.43	0.97	1.54	13.32
Phantom Ranch[1]	2,570	0.85	0.65	0.92	0.46	0.36	0.35	0.82	1.20	0.76	0.82	0.74	0.78	8.69
North Rim[1]	8,400	4.43	2.82	3.69	1.57	1.00	0.68	1.95	2.37	1.33	1.61	1.48	2.55	25.47
Mt. Trumbull[3]	5.600	0.78	0.62	0.81	0.56	0.52	0.48	1.72	1.89	0.98	0.74	0.72	0.83	10.63
Lees Ferry[1]	3,210	0.43	0.34	0.51	0.38	0.33	0.23	0.83	0.86	0.50	0.60	0.53	0.46	5.99
Supai[4]	3,205	0.65	0.69	0.85	0.38	0.42	0.28	1.10	1.41	0.63	0.64	0.77	0.67	8.48
Pierce Ferry[5]	3,860	0.90	1.00	1.37	0.79	0.53	0.35	0.88	1.52	0.78	0.61	1.06	0.95	10.73
Tuweep[1]	4,775	1.23	0.99	1.26	0.67	0.56	0.47	1.39	1.71	0.85	0.86	0.87	1.24	12.08

1. Period of Record 1951-1980
2. Period of Record 1960-1982
3. Period of Record 1948-1977, station now closed
4. Period of Record 1956-1982
5. Period of Record 1963-1982

Notes: Station title of north rim is Bright Angel RS. There are many gaps in the record for the north rim. Station title at south rim is Grand Canyon NP 2. Complete title for Pierce Ferry 17 SSW.

Practically all of the winter precipitation on the North and South Rims of the Grand Canyon occurs as snow. On the Coconino Plateau, south of the Grand Canyon, snow usually melts shortly after it falls, while on the Kaibab Plateau on the north side, much of the snow accumulates until spring when melting snow and rainfall recharge the underlying ground-water system and contribute to high seasonal runoff. The high seasonal runoff in combination with the rapid runoff during summer high-intensity, short-duration rainfall events effectively limits the amount of precipitation available for ground-water recharge within Kaibab Plateau.

3.2 Regional Geology

The Kaibab Plateau, on which the Hermit Mine prospect is located, is underlain by a thick sequence of horizontal to gently dipping Paleozoic rocks (570 to 225 million years before present). The sedimentary sequence, which is exposed in the walls of the Grand Canyon, ranges from about 3,500 to 4,500 feet thick and overlies highly-deformed Precambrian (older than 570 million years before present) sedimentary, metamorphic, and igneous rocks. The Precambrian rocks form the basement complex which for practical purposes constitute the lower limit of ground-water occurrence and movement (National Park Service, 1984). While some ground water undoubtedly occurs within the Precambrian, the quantities and its significance are small compared to those within the overlying sedimentary strata.

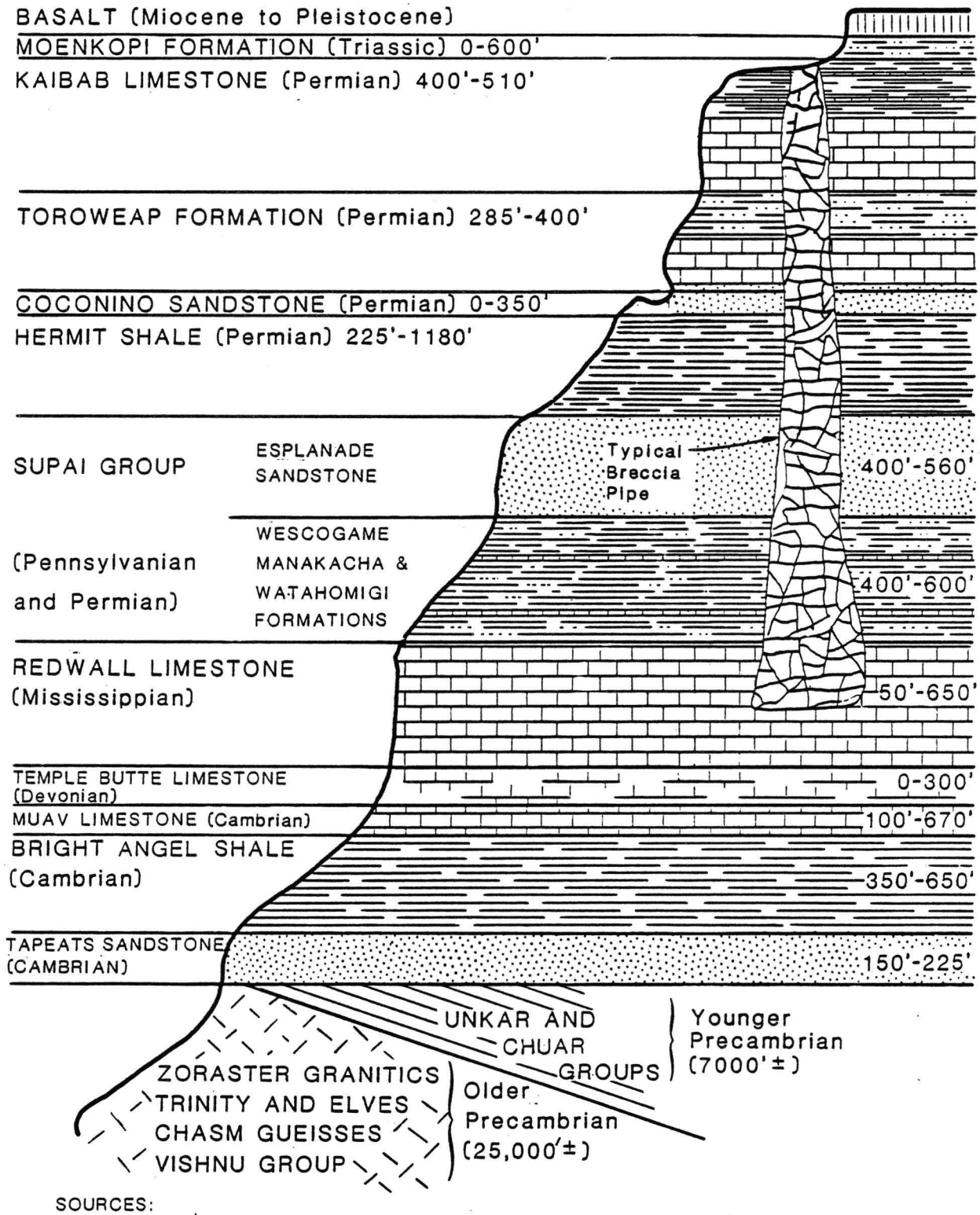
3.2.1 Stratigraphy

The generalized stratigraphy in the Hermit Mine site area is shown on Figure 2 and discussed below. Section 3.2.2 addresses the structural geology; Section 3.2.3 describes the occurrence and nature of breccia pipes, within the Colorado Plateau and their hydrogeological characterization.

In the Hermit Mine site area, the uppermost formation is the Moenkopi of Triassic age. The Moenkopi consists of red siltstone and claystone which outcrop directly at the surface or underlie the surface at a shallow depth. The formation in the mine site area ranges from about 100 to 500 feet in thickness.

Where is the moenkopi in the walls of the Grand Canyon?

The Moenkopi is underlain by the Kaibab and Toroweap limestones. These formations dip gently to the north and are exposed in the walls of the Grand Canyon. In the Hermit Mine area, the aggregate thickness of the Kaibab and Toroweap Formations is 600 to 800 feet. In the vicinity of the Hack Canyon and Pigeon Mines, the Toroweap Formation consists of a basal unit of sandstone and shale approximately 30 feet thick (Seligman Member), a 210-foot thick middle unit of fossiliferous grey limestone (Brady Canyon Member), and an upper, slope-forming unit of about 160 feet of gypsiferous shale and siltstone (Woods Ranch Member).



SOURCES:

- DEPT. OF INTERIOR, 1976, DRAFT ENVIRONMENTAL STATEMENT, GRAND CANYON
- NUEXCO, REPORT 176, APRIL, 1983

Arizona Strip District
Generalized Stratigraphy

Dames & Moore

Figure 2

ENERGY FUELS

The Kaibab Formation consists of a lower member of fossiliferous, cherty, limestone (Fossil Mountain Member) and an overlying sequence of thinly-bedded limestone, shale and gypsiferous siltstone (Harrisburg Gypsiferous Member).

The Coconino sandstone directly underlies the Toroweap limestone at a depth of 900 to 1,000 feet within the mine area. The Coconino ranges in thickness in the mine area from about 30 to 50 feet. In the canyon rim north of the visitor center at the Grand Canyon National Park, the Coconino sandstone is approximately 300 feet thick. The Coconino sandstone is a white, cross-bedded eolian deposit of Permian age.

The Coconino sandstone is underlain within the mine area at depths of 930 to 1,050 feet by the Hermit shale. The Hermit shale is a dense, clay-cemented siltstone and behaves as a confining bed under the coarser and more permeable Coconino sandstone. As a result of the permeability contrast between these units, perched ground-water conditions may exist locally above the contact. Also springs and seeps occur locally along the contact between those units in the canyon walls (Metzer, 1961).

The Hermit shale, in turn, is underlain by the Supai Formation which extends from about 1,050 to 2,300 feet below the surface. The upper few hundred feet of the Supai Formation is the resistant sandstone that resulted in the formation of the inner gorge of the Grand Canyon. The upper Supai Formation and the overlying Hermit shale are the main host rocks for the ore deposit at the Hermit prospect. The lower portion of the

Supai grades from a sandstone to a limestone which overlie the older limestones of the Redwall Formation (U.S. Forest Service, 1985).

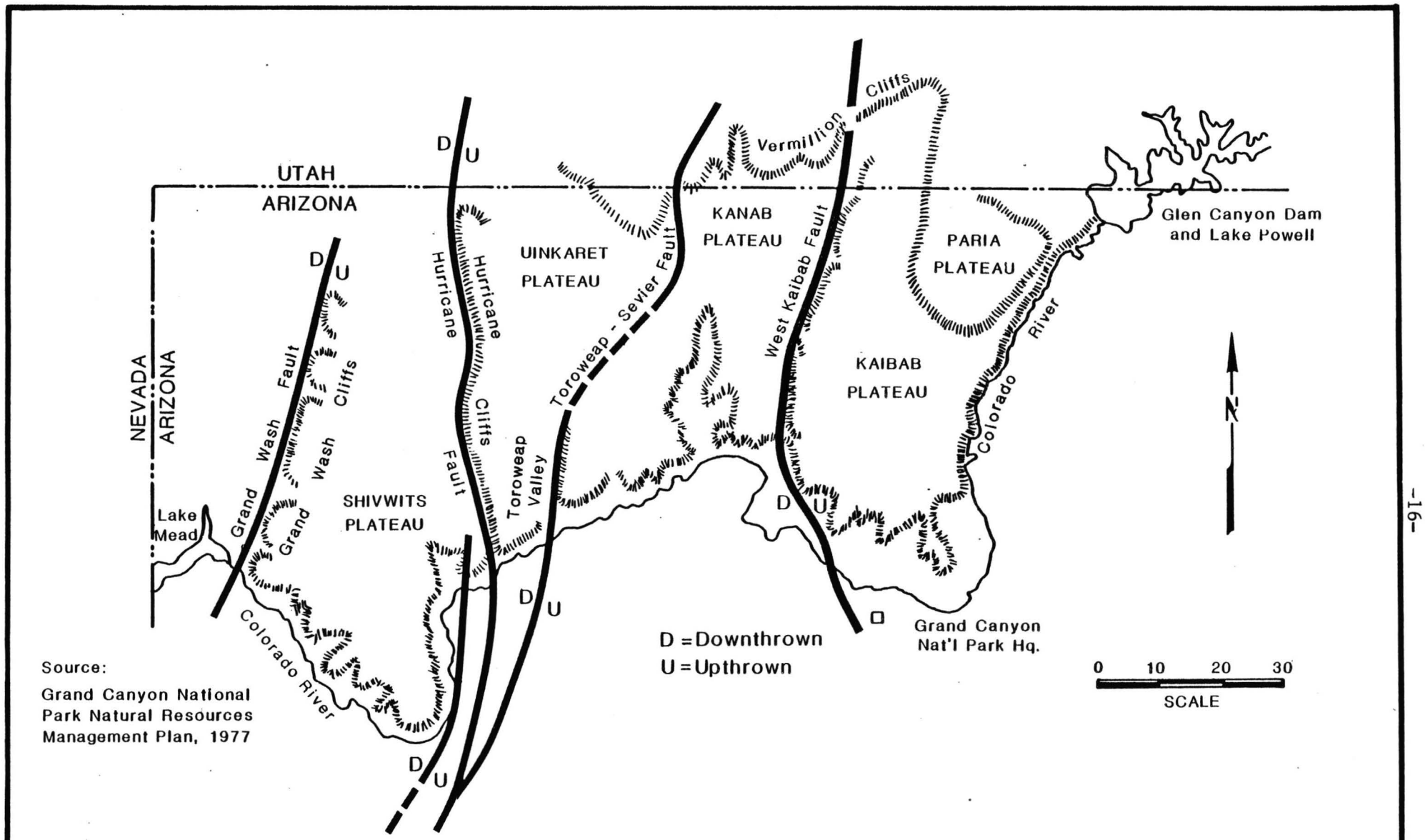
The Redwall and underlying Temple Butte and Muav limestones collectively comprise the Redwall-Muav aquifer of Northern Arizona. The Redwall limestone is a thickly-bedded, fine-grained limestone that typically is a cliff former where exposed along the walls of the Grand Canyon. In the area of interest, the Redwall is approximately 450 feet thick. The upper karstic member of the Redwall limestone is the source of the existing water supply for on-going operations at the Pigeon Mine, Kanab North, Pinenut, and the Canyon Mines. It is also the proposed source of water for the Hermit Mine.

The Temple Butte limestone, which underlies the Redwall, consists of interbedded dolomite, dolomitic sandstone, sandy limestone, siltstone and sandstone. It crops out as thin ledges and occupies small channels cut into the underlying Muav limestone. The Muav limestone consists chiefly of dolomitic limestone and is gradational with the underlying Bright Angel shale.

3.2.2 Structural Geology

Major north-south trending faults provide geologic and topographic boundaries to many of the plateaus (Figure 3). The Kanab Plateau on which the Hermit Mine is located, lies between the Toroweap-Sevier Fault on the west and the West Kaibab Fault on the east. Both of these faults trend

Dames & Moore



Source:
Grand Canyon National Park Natural Resources Management Plan, 1977

Arizona Strip District

Major Structural and Physiographic Features Map

Dames & Moore

Figure 3

north-northeast with movement on the order of hundreds of feet. The West Kaibab Fault and the East Kaibab Monocline form the boundaries of the Kaibab upwarp (Kaibab Plateau), topographically the highest of the area. The East Kaibab Monocline and the Vermillion Cliffs intervene between the Kaibab Plateau and the Paria Plateau to the northeast. The Kanab Valley Fault bisects the Kanab Plateau.

Movements along many of the faults began in the Miocene, but much of the activity peaked during Pliocene time. The faults are thought to be related to underlying Precambrian zones of weakness. Numerous smaller faults and folds are also present; these generally trend north, northwest, or northeast.

What folds?

3.2.3 Breccia Pipes

Roughly cylindrical, pipe-like collapse structures, termed breccia pipes, are common geologic features across the southern portion of the Colorado Plateau. The breccia pipes are relatively small in diameter, generally less than 500 feet, but may be thousands of feet deep. The pipes contain broken, rubbled rock from surrounding formations encircled by a series of concentric ring fractures. The more-permeable annular fault ring and the rock debris within the center of the pipe provided a vertical conduit for ascending and/or descending mineralizing fluids. When mineable ore occurs in a pipe, it typically is located in both the annualar fault ring and the central breccia matrix, principally in the Hermit and Supai Formations. Because the pipes are not known to extend below the Redwall

limestone, it is generally held that the pipes resulted from successive chimney collapse of the overlying formations into solution caverns developed within the Redwall limestone:

> "Geologists believe that cavities formed millions of years ago by dissolution of portions of the Redwall limestone [which] created space into which the overlying rock collapsed. The collapse zone propagated its way up hundreds, and in some instances, several thousands of feet in the form of a narrow cylinder or cone. This broken rock or pipe created a favorable environment for mineral deposition" (U.S. Forest Service, 1985).

Subsequent to the formation of the breccia pipes and mineralization, the materials within the pipe and in surrounding areas have been recemented and the void spaces filled with a fine-grained matrix consisting mainly of carbonaceous materials. As a result, the breccia pipe and the area around the pipe is effectively impermeable. Laboratory tests, for example, on rock core from the breccia pipe and surrounding areas at the Canyon Mine, (located south of the Grand Canyon), have shown the rock-mass hydraulic conductivities generally to be less than 1×10^{-9} cm/sec.

3.3 Ground-Water Occurrence and Movement

3.3.1 Colorado Plateau Region

The regional geology of the Colorado Plateau has been studied extensively by the U.S. Geological Survey, Energy Fuels, and others. The occurrence and movement of ground water within the plateau, however, have not been studied in the same level of detail, largely because of the depth

of occurrence throughout much of the region. The regional ground-water table throughout much of the plateau is controlled by the elevation of the Colorado River and its major tributaries which are deeply incised. Throughout much of the area, the depth to the regional water table is several thousands of feet beneath the tops of the plateaus.

Because of the depth of incisement of the Colorado River through the Colorado Plateau, the principal water-bearing zones of interest are exposed in the canyon wall. As a result, ground-water occurrence and ground-water chemistry within the Grand Canyon and its major tributary valleys have been studied in detail. These studies, which are based largely on direct surface observations and measurements, in combination with limited borehole and water-quality information for the plateau region, provide a comprehensive and coherent understanding of the regional hydrogeology both on the North and South Rims of the Grand Canyon.

Metzer (1961) describes the relationship between the geology and ground-water resources along the South Rim of the Grand Canyon and provides preliminary conclusions for quality and rates of recharge and discharge. Because of the similarities in the geology between the North and South Rims of the Grand Canyon, Metzer's conclusions also have direct relevance to the assessment of ground-water conditions and the prediction of the potential effects of mining on the Colorado Plateau, in general, and in the Hermit Mine area, in particular.

Huntoon (1982) reports on the results of investigations on ground-water circulation in the plateau regions adjacent to the Grand Canyon. Based on his studies, Huntoon concludes that the ground-water discharge from these regions occurs mainly to springs in the Grand Canyon. Specifically the major springs issue from the Redwall-Muav aquifer system, which is, as previously noted, the major aquifer system in Northern Arizona. Johnson and Sanderson (1968) also provides a compilation of data on ground-water discharge at springs along the Colorado River within the Grand Canyon.

Loughlin (1983) provides interpretations and conclusions on hydrodynamic conditions at the time of formation of breccia pipes in the Grand Canyon area and for ground-water circulation near important springs. The Grand Canyon National Park Water Resources Management Plan (National Park Service, 1984) provides a summary of hydrogeological and hydrochemical data for the park and adjacent areas.

The geology in combination with the low precipitation/high evapotranspiration losses leads to little water actually infiltrating and percolating downward to the regional water table. Although exact rates of natural ground-water recharge are not known, it is suggested that the rates of natural recharge are probably on the order of several hundredths to a few tenths of an inch per year, at best (Metzer, 1961).

Within the thick unsaturated zone above the regional water table, the sedimentary deposits are generally fine-grained and well cemented, although zones containing coarser sands do exist. A potential exists for perched

ground-water conditions to occur above the regional water table wherever a permeability contrast exists, for example immediately above the contact of the permeable Coconino sandstone with the underlying low permeability Hermit shale. Perched ground water may also be anticipated to occur as isolated or discontinuous lenses within the overlying Toroweap and Kaibab limestones. The existence of localized perched ground-water zones above the regional water table is manifested in isolated springs and seeps along the walls of the Grand Canyon and tributary canyons. The discharge from these perched zones is typically small, that is less than a few gallons per minute, and frequently intermittent.

The experience has been regionally that these isolated perched ground-water zones are not capable of being produced at a sustained rate for any length of time because of their limited areal extent and the slow rates of natural ground-water recharge. Consequently, it can be anticipated that if perched ground-water zones are encountered during mining, they may produce small quantities of water initially, but the yield can be expected to decrease with time and frequently to cease altogether within a period of several weeks or months. This is consistent with observed conditions during mining at the Hack Canyon and Pigeon Mines where aggregate inflow to the mine workings has decreased from about 10 to less than 5 gallons per minute.

3.3.2 Site-Specific Conditions

The proposed mine plan for the Hermit Mine calls for the extraction of uranium ore from an approximate 600 foot interval within the breccia pipe. The ore body would be accessed by construction of a 1,100-foot vertical shaft located outside of the mineralized zone and by extending horizontal drifts into the mineralized zones within the breccia pipe. The final depth of mining will be nearly 1,000 feet above the regional ground-water table which is within the Redwall-Muav limestone aquifer. Consequently, it is not expected that significant ground-water inflow to the mine itself will occur. Isolated zones and some fractures above and in the area of the planned mine workings are known to contain perched ground water. Specifically, perched ground water has been encountered in the Toroweap limestone and within the Coconino sandstone immediately above the top of the Hermit shale. During mine development, these perched ground-water zones may cause water to collect in the mine workings, requiring pumping to the ground surface. It is further expected that as mining progresses the inflow to the mine from any perched zones that are encountered will decrease; resulting in the expectation that the Hermit Mine will be essentially dry in the latter phases as have been the cases in the Hack Canyon and the Pigeon Mines.

The perched ground-water zone within the Toroweap limestone at the location of the proposed Hermit Mine has been developed to provide water for livestock. The well at this location can be produced at about 2 gpm on an intermittent basis only. The potential yield from the perched ground-water zone at the base of the Coconino sandstone is believed to be very small.

3.4 Ground-Water Quality

Existing data on the quality of ground-water inflow to existing mines within the Colorado Plateau are limited primarily because of its infrequent occurrence. The analytical results for a sample collected from the Pigeon Mine in August, 1986 by Energy Fuels together with the results of ground-water samples from wells in the area are summarized in Table 2. A description of the wells listed in Table 2 is given in Table 3.

The Pigeon Mine water sample was collected from the discharge to the main sump at the lowest working level in the mine and represents water that has percolated downward through the workings. The sample, therefore, should be representative of mine water. The water is a strongly bicarbonate type indicating neutral to basic pH conditions within the mine. The sample, however, except for radiochemistry, meets all Primary Drinking Water Standards and exceeds the Secondary Drinking Water Standards only for sulfate (851 mg/l) and total dissolved solids (1,920 mg/l). The radiochemistry for the Pigeon Mine sample is summarized in Table 4.

TABLE 2

SUMMARY OF RESULTS FOR CHEMICAL ANALYSIS FOR GROUND-WATER SAMPLES
FROM WELLS WITHIN THE ARIZONA STRIP
(Constituent Levels Exposed In Mg/L)

Well Name/Ref. No.	Pigeon Mine	Pigeon #4	Hack #10	Hunt #5	Kanab #6	Maximum Allowable	
Well Reg. No.	Main Sump	503711	640855(1)	503919	509198	Contaminated Level	
Aquifer	---	RW	BP	K/T	RW	(MCL)	(MCL)
Date Sampled	8/22/86	10/4/82	10/4/82	8/4/83	12/6/85	(2)	(3)
Constituent							
Arsenic	<0.01	<0.02	<0.02	0.028	<0.01	(0.05)	(0.05)
Barium	<0.1	<0.50	0.05	<0.5	<0.05	(1.0)	(1.0)
Cadmium	<0.0001	<0.01	-0.013	<0.005	<0.005	(0.01)	(0.01)
Chromium	<0.001	<0.05	<0.05	<0.01	<0.01	(0.05)	(0.05)
Fluoride	0.07	1.6	1.1	1.2	1.0	(1.4-2.0)	(1.4-2.4)
Lead	<0.001	<0.02	0.21	0.024	<0.02	(0.05)	(0.05
Mercury	<0.00006	<0.002	<0.002	<0.001	<0.001	(0.002)	(0.002)
Nitrates	---	0.086	0.055	0.2	<0.20	(10.0)	(45.0)
Selenium	<0.01	0.0050	<0.01	0.005	<0.005	(0.01)	(0.01)
Silver	<0.0001	<0.02	<0.02	0.02	<0.02	(0.05)	(0.05)
Alkalinity	337.0	245.0	186.5	260.0	204.0	N/A	N/A
Calcium	179.0	142.0	131.0	570.0	435.0	N/A	N/A
Chloride	---	31.3	26.3	18.0	72.0	N/A	500.0
Copper	<0.001	0.01	0.01	<0.05	<0.05	N/A	1.0
Iron	0.05	2.0	<0.05	2.2	<0.1	N/A	0.3
Magnesium	202.0	40.0	59.0	175.0	170.0	N/A	N/A
Manganese	0.05	0.0	0.02	<0.05	<0.05	N/A	0.05
Sodium	99.0	104.0	717.0	25.0	128.0	N/A	N/A
Sulfate	851.0	890.0	3,560.0	2,020.0	1,535.0	N/A	500.0
TDS	1,920.0	---	---	2,980.0	2,570.0	N/A	1,000.0
Zinc	2.5	<0.05	1.11	5.4	<0.05	N/A	5.0
Uranium	0.17						

Aquifer: RW = Redwall/Muav
BP = Breccia Pipe
K/T = Kaibab/Toroweap

(1) Sample was taken after passing through a water softener.
(2) Arizona Department of Health Services.
(3) Federal drinking water standards.

TABLE 3

WATER WELL STATISTICS

WELL NAME/ REF. NO.	REGISTRATION NUMBER	WELL DEPT.	STATIC WATER LEV.	YIELD (GPM)	PRINCIPAL AQUIFER
Pigeon Well/ #4	503711	2,350	1,736	10	Redwall Ls.
Hunt Well+/ #5	503919	660	370	2	Toroweap Fm.
Kanab North Well/#6	509198	2,700	1,470	10	Redwall Ls.
Hack Canyon/ #10	640855	1,475	1,096	5	Breccia Pipe

Note: N/A - Not Available.

+ - Hunt Well #5 is located at the Hermit Mine Site.

TABLE 4

RADIOCHEMISTRY, PIGEON MINE WATER

Gross Alpha (pCi/l), Total	331 ± 36
Gross Beta (pCi/l), Total	99 ± 17
Radium 226 (pCi/l), Total	39 ± 1.6
Radium 228 (pCi/l), Total	1.4 ± 1.6

4.0 HYDROGEOLOGICAL CHARACTERISTICS OF BRECCIA PIPES

As discussed previously in Section 3.2.3, mineralization in the Hermit Mine area occurs in or near a breccia-pipe structure that cuts vertically through the flat-lying sedimentary strata. Cavities formed millions of years ago by dissolution of portions of the deeper Redwall limestone created cavities which resulted over time in the collapse of the overlying strata. The collapse zone propagated upward through the overlying strata several hundreds of feet forming a cylinder or narrow cone filled with breccia or rock fragments.

Geochemical changes within the breccia zone resulted in cementation of the breccia or broken rock infilling the voids with a fine-grained matrix, and depositing uranium and other minerals including silver and copper. As a result of the primary and secondary mineralization, the breccia zone is denser and less permeable than the surrounding rocks. Laboratory tests on rock core from the Canyon Mine prospect, which is located on the South Rim of the Grand Canyon, confirm the dense nature and low hydraulic conductivity of the material both within the breccia pipe and in the natural materials immediately surrounding the pipe. The results of the laboratory measurements which are summarized in Table 5 indicate that the geologic materials immediately surrounding the pipe are effectively impermeable with measured hydraulic conductivities less than 1×10^{-9} cm/sec. In comparison, the measured hydraulic conductivities for the material from inside the breccia pipe but not within the uranium ore zone range from 2.0

x 10^{-7} to 1.4 x 10^{-6} cm/sec. Measured hydraulic conductivities for three samples taken within the pipe but below the proposed depth of mine were less than 1 x 10^{-8} cm/sec.

Canyon Mine is south of GCNP, R/M aquifer is in Muav Limestone, R/M aquifer at Hermit Mine is in Suprise Canyon Conglomerate

Some sample values and depths differ between Montgomery & associates versus Dames and Moore

TABLE 5

LABORATORY HYDRAULIC CONDUCTIVITY OF ROCK CORE SAMPLES, CANYON MINE

Sample	Sample Description	Depth Below Ground Surface -Feet-	Hydraulic Conductivity -cm/sec-
1	Sandstone/siltstone-outside pipe	2,020	2.2×10^{-10}
2	Sandstone/siltstone-outside pipe	2,303	1.3×10^{-11}
3	Sandstone/siltstone-outside pipe	2,045	9.4×10^{-11}
4	Sandstone/siltstone-outside pipe	2,059	$<3.4 \times 10^{-13}$
5	Sandstone/siltstone-outside pipe	- SAMPLE FAILED -	
6	Sandstone/siltstone-outside pipe	2,285	1.2×10^{-11}
7	In pipe, but not in uranium ore zone	2,299.25	2.0×10^{-7}
8	In pipe, but not in uranium ore zone	1,381.50	6.1×10^{-7}
9	In pipe, but not in uranium ore zone	1,188.50	1.4×10^{-6}
10	In pipe below 2,000 foot level	2,012	1.6×10^{-9}
11	In pipe below 2,000 foot level	2,073	7.0×10^{-9}
12	In pipe below 2,000 foot level	2,133	4.7×10^{-9}

Sample 7 failed

5.0 POTENTIAL IMPACT OF MINING OPERATIONS

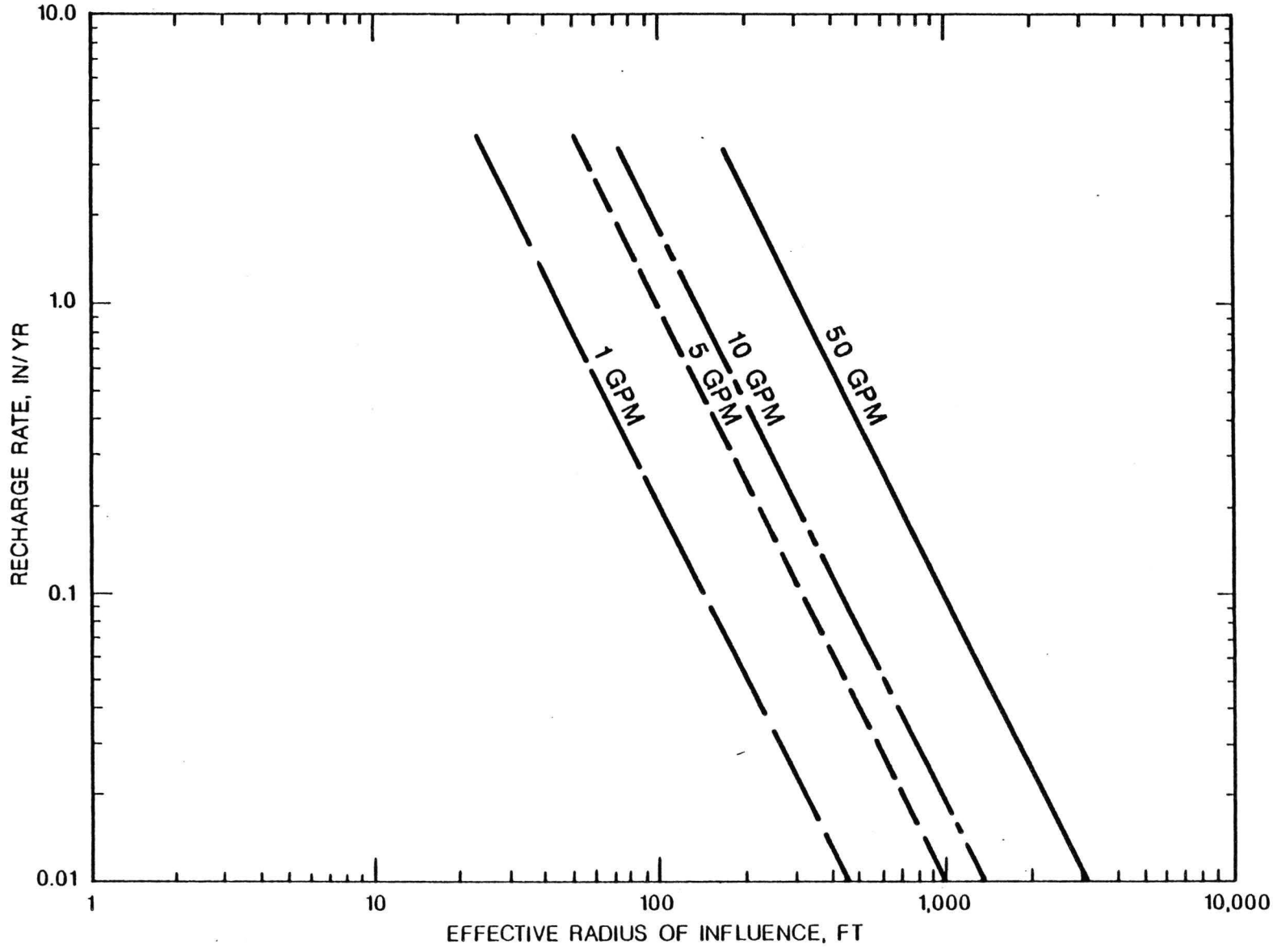
Experience to date has shown that the rates of ground-water inflow to the existing mines in the Kanab Plateau decrease with time and are small, that is less than 5 gallons per minute. Following cessation of mining, it can be expected that ground-water inflow to the mine workings will continue and that with time a potential exists for the mine workings to partially fill with water. In that the mine workings are above the regional water table which is believed to be some 1,000 feet below the depth of mining, a potential will exist for downward seepage from the mine to the regional water table. The rates of filling of the mine workings and the rates of downward seepage will depend on the hydraulic transmission and storage characteristics of the overlying, underlying and adjacent strata. The low rates of natural ground-water recharge is evidenced by the limited and localized occurrence of perched ground-water conditions above the regional water table and the fact that the yield from their perched zones generally is not sustainable, even at low pumping rates.

Perchered groundwater is flowing downward. Is in the Hermit at Hack Mines and Supai at Kanab North

The experience at the Hack Canyon and Pigeon Mines has been that perched ground-water conditions can be expected to be encountered during sinking of the shaft and mining. The aggregate rates of inflow to the workings at both the Hack Canyon and Pigeon Mines, however, have been small, that is less than about 5 gallons per minute. The inflow, which is largely associated with localized perched zones at or near the top of the Hermit shale, has decreased with time and is currently less than a few

gallons per minute. Also of importance is that the quality of the inflow to the mine workings as indicated by analysis of water samples from the Pigeon Mine is very good. The quality of the water in the main sump in the bottom of the Pigeon Mine meets all Primary Drinking Water Standards, except for radiochemistry, and exceeds the Secondary Standards only for sulfate and total dissolved solids.

The effect of intercepting "perched" ground-water conditions during mining will be localized due to the discontinuous nature of ground-water occurrence above the regional water table. Parametric analyses based on observed conditions during mining at the Hack Canyon and Pigeon Mines further supports the localized nature of the potential impacts. Given low, but reasonable rates, of natural ground-water recharge and actual rates of ground-water inflow to the mine workings at the existing mines, it can be shown that the effective radius of influence as a result of intercepting perched conditions will be small and typically less than a few thousand feet. This relationship between rate of ground-water inflow to the mine workings, rate of natural ground-water recharge, and the "effective" radius of influence is shown on Figure 4. As can be seen from Figure 4, the effective radius of influence is not highly sensitive to the assumed rate of natural recharge for a given aggregate mine inflow rate and in the worst case less than several thousands of feet.



Effective Radius of Influence as a Function of
Aggregate Mine Inflow and Rate of Ground-water Recharge

Dames & Moore

Figure 4

The proposed depth of mining within the mineralized portion of the breccia pipe at the Hermit site will be approximately 1,000 feet above the regional ground-water table within the Redwall-Muav aquifer. Laboratory tests on rock core from within the breccia pipe but below the depth of uranium mineralization have shown the rock mass to be effectively impermeable. Measured hydraulic conductivities for the non-mineralized portions of the breccia pipe below the depth of mining were less than 1×10^{-8} cm/sec. This compares measured hydraulic conductivities of less than 1×10^{-9} cm/sec for the altered sandstone and siltstone units adjacent to, but outside of the breccia pipe and measured values of 2.0×10^{-7} to 1.4×10^{-6} cm/sec for non-mineralized portions of the pipe within the zone of mining.

In summary, recementation of the collapse breccia within the pipe and the alternation and recementation of the sedimentary units immediately around the pipe have resulted in a very low permeability environment. Because of the very low permeabilities and the physical separation, the potential for any direct impact on water quality or quantity within the Redwall-Muav limestone aquifer is negligible.

In addition to these physical factors which limit the potential for water quality or quantity impacts with the Redwall-Muav aquifer, adsorption of heavy metals and radioactive constituents on the surfaces of clays as well as chemical reactions with the rock strata will tend to minimize or eliminate any short-term or long-term potential water-quality impacts.

Thick sequences of argillaceous mudstones and limestones with high adsorptive capacities physically separate the uppermost aquifer within the Redwall-Muav limestones and the proposed depth of mining.

Although regionally, breccia pipes are a common geologic feature within the Colorado Plateau, only a relatively few contain sufficient uranium mineralization to be commercially mineable. These breccia pipes, as discussed, are typically small in diameter - that is less than 300 to 500 feet. Given the existing geologic and hydrogeologic conditions in and in the immediate area of mineralized breccia pipes in the Colorado Plateau, it is highly improbable that the development, and mining of selected breccia pipes such as at the proposed Hermit Mine site will have a measurable or quantifiable impact on ground-water quality or quantity within the Redwall-Muav aquifer. It can be expected that mine development may locally dewater perched ground-water systems which exist within the thick unsaturated zone above the regional water table. Any effect on these perched systems, however, will be limited to the immediate mine area.

The perched aquifer, north of the GCNP, is continuous - but deepens as it flows south toward the Grand Canyon

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File Divider Page

CTS-43973
1-26728

Construction Completion Report

Cell 1B

Rainbow Valley Landfill

Maricopa County, Arizona

Glenn Weinberger, Inc.

November 7, 2001

ARIZONA DEPARTMENT OF
ENVIRONMENTAL QUALITY

NOV 13 2001

RECEIVED
PLAN REVIEW UNIT
SOLID WASTE SECTION
WASTE PROGRAMS DIVISION

AMMTEC CONSULTING, INC.
2447 W. 12th St., Ste. 1, Tempe, AZ 85281
480-927-9696 P ● 480-927-9797 F

Project No. PX 1001.001.04

AMMTEC CONSULTING, INC.
GEOTECHNICAL • ENVIRONMENTAL • TESTING • INSPECTION • LABORATORY SERVICES

November 7, 2001
Project No. PX 1001.001.04

Mr. Richard Jeffries
Solid Waste Plan Review Unit
Arizona Department of Environmental Quality
3033 North Central Avenue
Phoenix, Arizona 85012

Subject: **Construction Completion Report, Cell 1B Rainbow Valley Landfill, Glenn Weinberger Incorporated, Maricopa County, Arizona**

Dear Mr. Jeffries:

On behalf of Glenn Weinberger Incorporated (GWI), AMMTEC Consulting, Inc. (AMMTEC) is pleased to present this construction completion report Cell IB at the Rainbow Valley Landfill.

GWI contracted directly with AMMTEC to perform construction quality assurance (CQA) and construction certification for Cell 1B at the Rainbow Valley Landfill near Mobile, Arizona. The enclosed report documents the as-built construction of the landfill bottom layers at the Rainbow Valley Landfill. This report includes a summary of the project history, as-built records, of the excavated cell topography, and CQA information.

Based on the results of field CQA testing and construction observations, Cell 1B of the Rainbow Valley Landfill has been constructed in substantial conformance with the approved plans, (Reference: Solid Waste Facility Plan/Aquifer Protection Permit No. P-102800.)

If you have any questions, please do not hesitate to contact me at (480) 927-9696 or at ammtecsa@qwest.net.

Sincerely,

AMMTEC CONSULTING, INC.

Syed S. Amanatullah, P.E.
Engineering Manager, VP

Enclosure

cc: Glenn Weinberger, GWI

2447 W 12th Street, Suite 1 Tempe, AZ 85281 Phone: (480) 927-9696 Fax: (480) 927-9797

CONSTRUCTION COMPLETION REPORT

CELL 1B
RAINBOW VALLEY LANDFILL

MARICOPA COUNTY, ARIZONA

Prepared for

Glenn Weinberger, Incorporated

November 7, 2001

Prepared by

AMMTEC Consulting Inc.
2447 West 12th Street, Suite 1
Tempe, Arizona 85281

Project PX 1001.001.04

Construction Completion Report
Cell 1B
Rainbow Valley Landfill
Maricopa County, Arizona

The material and data in this report were prepared under the supervision and direction of the undersigned.

AMMTEC CONSULTING, INC.



Tamara M. Long, Engineer

Syed S. Amanatullah, P.E.
Engineering Manager, VP

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APPENDIX B	PROJECT SITE PICTURES
APPENDIX C	LABORATORY SOILS ANALYSIS
APPENDIX D	PROJECT DOCUMENTATION

1 INTRODUCTION

On behalf of Glenn Weinberger, Incorporated (GWI), AMMTEC Consulting, Inc. (AMMTEC) has prepared this Construction Completion Report to the Arizona Department of Environmental Quality (ADEQ) Solid Waste Plan Review Section for the construction of Cell 1B at the Rainbow Valley Landfill with reference to the facility's Solid Waste Facility Plan/APP No. P-102800.

This report will document the as-built construction of Cell 1B at the Rainbow Valley Landfill and includes attachments for this construction completion report. This report will also reference previously approved documents relating to the Solid Waste Plan/Aquifer Protection Permit for this facility.

Supporting data and information that are included in this report are listed below:

- Project background;
- Summary of organizations responsible for project completion;
- Descriptions of major construction components;
- Project site photographs;
- Quality assurance information, and;
- As-built documentation.

Other information regarding the Rainbow Valley Landfill and this proposed modification are contained in the appendices. Appendix A contains as-built drawings of the excavated Cell 1B, Appendix B contains project site pictures, Appendix C contains the laboratory soils analyses, and Appendix D contains project documentation.

1.1 Facility Description

The Rainbow Valley Landfill is a construction and demolition debris landfill located at 99th Avenue and approximately 2 miles north of Hwy 238 in Mobile, Maricopa County, Arizona. The facility was issued ADEQ APP No. P-102800, August 24, 1995. The permit provides authorization to construct and operate the Rainbow Valley Landfill. A vicinity map is shown in Appendix A. Access to the facility area is from Hwy 238 and 91st Avenue.

Appendix A includes a vicinity map showing the location of the Rainbow Valley Landfill and also includes a site map depicting Cell 1A and Cell 1B at the Rainbow Valley Landfill.

The legal description of the site is the Phoenix Active Management Area in Township 2 North, Range 1 West, Sections 25 and 26, Gila and Salt River Base Line and Meridian:

Latitude 33° 5' 38"

Longitude 112° 19' 30"

The Rainbow Valley Landfill is a Construction and Demolition (C&D) debris landfill and accepts only C&D waste from the Glenn Weinberger transfer station location at 43rd Avenue, in Phoenix Arizona. No public C&D waste is accepted at the Rainbow Valley Landfill.

2 BACKGROUND

The Rainbow Valley Landfill APP incorporates a previously approved minor modification for an alternative bottom liner and final cover system. This minor modification is referenced as the *Equivalency Demonstration for Alternative Bottom Liner and Final Cover Systems, Minor Modification to APP No. 102800, Rainbow Valley Landfill, March 31, 1999, EMCON,* and included HELP 3.05 modeling that predicted no leakage from the base of the landfill when modeled with the alternative design configuration.

The approved alternative bottom liner system consists of a 12-inch native soil layer, a 12-inch scarified/recompacted native soil layer, and a 24-inch native soil operations layer. This construction completion report is to document that this bottom liner system was installed in Cell 1B at the Rainbow Valley Landfill.

A Construction Quality Assurance (CQA) manual for the alternative design configuration was also included with the previously approved minor modification and is referenced as, *Quality Assurance Manual for Construction of Alternative Final Cover and Liner Systems, Rainbow Valley Landfill, EMCON, March 31, 1999.* This CQA manual provided construction testing standards and frequencies, construction monitoring requirements, and record keeping requirements.

3 PROJECT ORGANIZATION

3.1 Project Owner

The project owner is Glenn Weinberger Incorporated (GWI).

3.2 Project Engineer

GWI directly contracted with AMMTEC for project engineering, construction quality assurance, and this construction completion report. The As-Built Surveys were performed by Stanley Consultants, Inc. (Stanley). Laboratory testing was performed by AMMTEC and Alpha Geotechnical & Materials, Inc. (Alpha).

3.3 Project General Contractor

GWI served as the general contractor and performed the excavation and construction of Cell 1B. Representatives of GWI can be contacted at: Glenn Weinberger Incorporated, 3425 South 43rd Avenue, Phoenix, Arizona, 85009.

4 FOUNDATION LAYERS

4.1 Cell 1B Excavation

Cell 1B at the Rainbow Valley Landfill was excavated to a maximum of approximately 58 feet below grade. As shown in Appendix A, the current surface elevation is approximately 1260 feet above mean sea level (amsl), and the bottom of the excavated cell is approximately 1202 feet amsl. A topographic survey of the excavated cell was performed by Stanley on April 4, 2001, and is included in Appendix A.

The south slope of Cell 1B has a slope of 4:1 from the surface grade to the excavated cell bottom grades. The excavated cell bottom area has gentle slopes downward from south to north. The excavated soil from Cell 1B was stockpiled at an area northeast of Cell 1B on the GWI property.

4.2 Excavated Soil for Bottom Liner Layers

Existing native soil at the Rainbow Valley Landfill was used as material for construction of the landfill bottom layers. The soil was excavated from an existing slope north of Cell 1A.

4.3 Bottom Liner Layers

The bottom liner layers consisted of a 12-inch native soil layer as the lowermost layer, a 12-inch recompacted soil layer, and a 24-inch operations layer. Construction of the bottom liner layers began on June 18, 2001 and was completed on September 19, 2001.

On the surface of the 12-inch native soil layer, the recompacted soil layer was installed on the south slope of Cell 1B in 6-inch lifts. Soil tests were performed after construction of the 12-inch recompacted soil layer. A 24-inch operations layer was then installed over the 12-inch recompacted soil layer.

Installation of the recompacted soil layer then progressed to the floor areas of Cell 1B with approximately 2 feet of overlap onto the south slope. Additional soil tests were performed after the construction of the 12-inch recompacted soil layer at the floor areas of Cell 1B. A 24-inch operations layer was then installed over the recompacted soil layer at the floor areas of Cell 1B.

4.4 Cell 1B Utilization for Landfill Operations

Due to space constraints for landfill operations in Cell 1A, notification to ADEQ (by letter dated August 17, 2001), was provided by AMMTEC so that constructed portions of Cell 1B could be utilized. The constructed portion consisted of the west half of the floor area of Cell 1B.

Required CQA tests were performed on the constructed portions of Cell 1B prior to utilization for landfill operations. A temporary berm for on-site drainage management was installed at the working faces of Cell 1B as construction activities continued on the remaining portion of Cell 1B.

4.5 Project Documentation

Project documentation consists of photographs taken at the project site, field reports, and a project equipment list. Project site photographs are contained in Appendix B and field reports are contained in Appendix D.

4.6 Drainage Controls

Temporary berms were built at the working faces of the construction areas to control stormwater drainage. A permanent soil berm was constructed along the east and north boundaries of Cell 1B on top of the 24-inch operations layer. This berm will prevent run-on due to off-site stormwater runoff.

4.7 Environmental Controls

Water was sprayed regularly on haul roads and working areas to minimize dust. Removal of soils was performed when an oil leak was detected in one of the site equipment.

5 QUALITY ASSURANCE

Quality assurance was performed by AMMTEC as per the CQA manual, *Quality Assurance Manual Construction of Alternative Final Cover and Liner Systems, Rainbow Valley Landfill, March 31, 1999, EMCON.*

5.1 Soil Material Evaluation

Prior to construction activities, a soil sample was taken from the existing slope north of the Cell 1A that was to be used for the construction of the landfill's bottom layer system. Geotechnical analytical results of this soil showed an average permeability of 4.2×10^{-6} cm/sec, a maximum dry density at 112.5 pounds per cubic foot, and an optimum moisture content of 14.4 percent.

5.2 Construction Requirements

The recompacted soil layers are specified in the APP permit to have a compaction quality of at least 95 percent and hydraulic conductivities of less than or equal to 1×10^{-5} cm/sec.

5.3 Construction Testing

Major areas of construction at Cell 1B can be described as the south slope area, the west half of the floor area, and the east half of the floor area. After construction of the recompacted soil layers at each of the major areas, field tests were performed and soil samples were taken for laboratory analysis according to the CQA manual.

Geotechnical analysis using appropriate ASTM standards were conducted on samples from the 12-inch recompacted soil layer. ASTM D5084 was used for permeability analysis, ASTM D698 for laboratory moisture density, and a Troxler Surface Moisture Density Gauge was used for field soil density and moisture content measurements.

Permeability test results are summarized in Table 1. Three soil samples, SP-1, SP-2, and SP-3, were taken from the site using a Shelby tube and permeability analysis was performed by Alpha. The test results indicate that soil samples SP-1, SP-2, and SP-3 meet the permeability requirements.

Field moisture-density tests utilizing the Troxler Surface Moisture Density Gauge were performed at various locations and the results are summarized in Table 2. The results show that field density tests for samples FS-1, FS-2, FS-3, FS-4, FS-5, FS-6, FS-7, FS-8, FS-9, FS-10, FS-11, and FS-12 were within specification for compaction.

The locations of field tests and soil sample locations are shown in Plate 1.

5.4 Field Engineering Services

Field engineering services were provided by AMMTEC.

5.5 Laboratory Analytical Services

Laboratory analytical services for soils testing were provided by AMMTEC and Alpha.

5.6 Documentation

Documentation for the soils testing including sieve analysis, moisture-density, and permeability are contained in Appendix C and are also summarized in Tables 1 and 2 of this report. Documentation for the field soil tests are contained in Table 3.

6 CONCLUSION

All construction described in this report was performed by GWI. Field testing was performed by AMMTEC and laboratory analyses were performed by AMMTEC and Alpha. Based upon the information and as-built surveys provided by AMMTEC and Stanley, the Rainbow Valley Landfill Cell 1B construction project was completed.

TABLES

TABLE 1

Soil Permeability Test Results

ASTM D5084

Cell 1B – Rainbow Valley Landfill

SAMPLE DATE	SAMPLE LOCATION	SAMPLE IDENTIFICATION	AVERAGE PERMEABILITY (cm/sec)
7/9/01	South Slope	SP-1	1.7×10^{-7}
8/6/01	Floor Area (West Half)	SP-2	1.3×10^{-7}
9/7/01	Floor Area (East Half)	SP-3	6.6×10^{-8}

TABLE 2

Soil Moisture Density Analysis

ASTM D698

Cell 1 B – Rainbow Valley Landfill

SAMPLE DATE	SAMPLE LOCATION	SAMPLE IDENTIFICATION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)
7/9/01	South Slope	SS-1	112.2	12.6
8/6/01	Floor Area (West Half)	SS-2	113.9	13.0
9/7/01	Floor Area (East Half)	SS-3	109.7	14.2

TABLE 3

Field Soil

Optimum Moisture Density Relationship

ASTM D698

Cell 1B – Rainbow Valley Landfill

SAMPLE DATE	SAMPLE LOCATION	SAMPLE IDENTIFICATION	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (pcf)	RELATIVE COMPACTION (%)
7/9/01	South Slope	FS-1	13.9	115.3	112.2	100
7/9/01	South Slope	FS-2	11.5	115.7	112.2	100
7/9/01	South Slope	FS-3	12.8	109.0	112.2	97
7/9/01	South Slope	FS-4	15.4	109.4	112.2	98
8/6/01	Floor Area (West Half)	FS-5	12.8	117.6	109.9	100
8/6/01	Floor Area (West Half)	FS-6	13.1	116.6	109.9	100
8/6/01	Floor Area (West Half)	FS-7	11.9	112.4	109.9	100
8/6/01	Floor Area (West Half)	FS-8	12.4	111.9	109.9	100
9/7/01	Floor Area (East Half)	FS-9	14.9	113.3	113.9	100
9/7/01	Floor Area (East Half)	FS-10	12.5	113.7	113.9	100
9/7/01	Floor Area (East Half)	FS-11	14.8	109.0	113.9	98
9/7/01	Floor Area (East Half)	FS-12	17.2	109.4	113.9	96

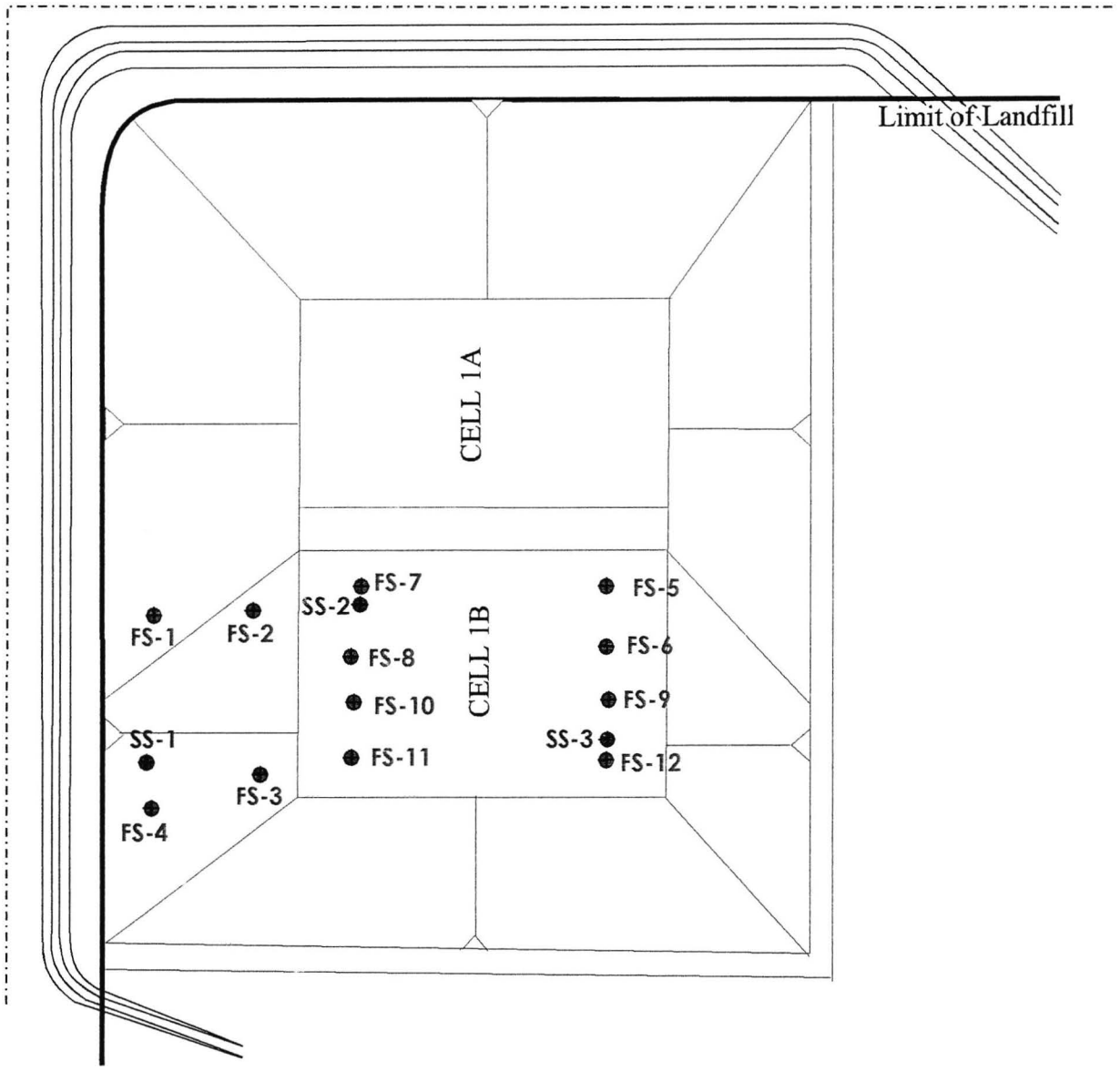
TABLE 4

Equipment List

Cell 1B – Rainbow Valley Landfill

EQUIPMENT	MANUFACTURER	MODEL NUMBER
Dozer	CAT	D6H
Compactor	Ingersoll Rand	70
(2) Scraper	CAT	621F
Grader	Komatsu	GD650A
Water Truck	Mega	5000

PLATE



● Field Soil Test Locations

● Soil Sample Locations

N

Approximate Scale
1 Inch = 200 Feet

0 200 400

AMMTEC CONSULTING, INC.

Date: October 18, 2001
Project Number: PX-1001.001.04

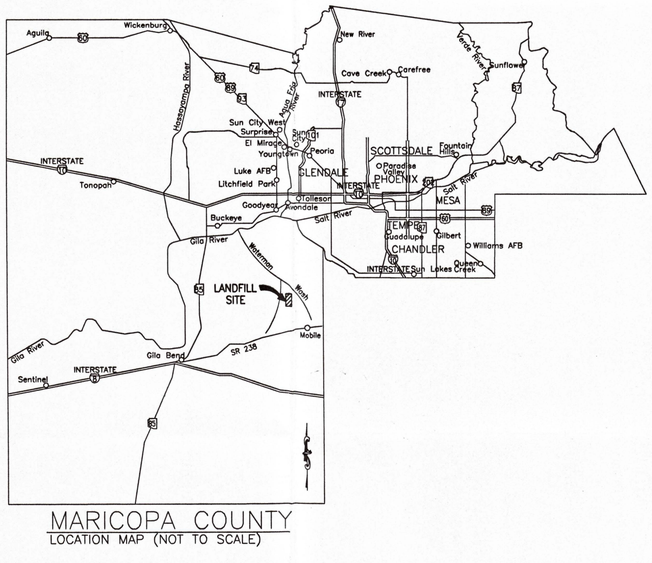
Cell 1B Field Test & Soil Sample Locations
Rainbow Valley Landfill
Glenn Weinberger, Inc.
Mobile, Arizona

Plate
1

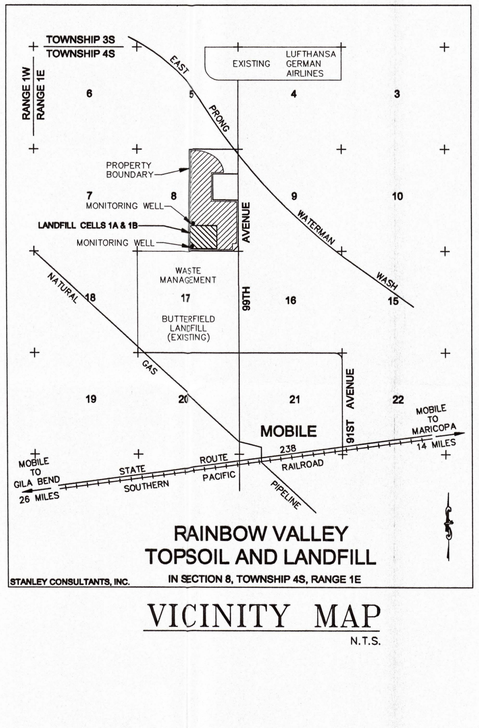
APPENDIX A

AS-BUILT DRAWINGS

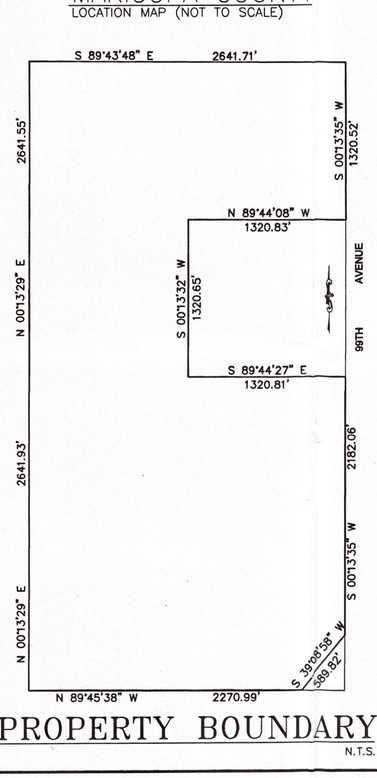
AS-BUILT SURVEY
FOR
RAINBOW VALLEY TOPSOIL AND LANDFILL
CELLS 1A AND 1B



MARICOPA COUNTY
LOCATION MAP (NOT TO SCALE)



VICINITY MAP
N.T.S.



PROPERTY BOUNDARY
N.T.S.

ALL BEARING AND DISTANCES SHOWN ARE MEASURED.
SOURCE: SCI PROJECT NO. 12066.

LEGAL DESCRIPTION

THE EAST HALF OF SECTION 8, TOWNSHIP 4 SOUTH, RANGE 1 EAST, OF THE GILA & SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA EXCEPTING THERE FROM ANY PORTION OF LAND LYING WITHIN THE FOLLOWING DESCRIBED PROPERTIES;

1. THE EAST 55' OF SAID SECTION 8;
2. THE NORTH HALF OF THE SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SAID SECTION 8;
3. THE SOUTH HALF OF THE SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SAID SECTION 8;
4. BEGINNING AT THE SOUTHEAST CORNER OF SAID SECTION 8; THENCE NORTH 89 DEGREES 45 MINUTES 38 SECONDS WEST ALONG THE SOUTH LINE OF SAID SECTION 8, A DISTANCE OF 370.57 FEET; THENCE NORTH 39 DEGREES 08 MINUTES 58 SECONDS EAST, A DISTANCE OF 589.82 FEET TO THE EAST LINE OF SAID SECTION 8; THENCE SOUTH 00 DEGREES 13 MINUTES 35 SECONDS WEST ALONG THE EAST LINE OF SAID SECTION 8, A DISTANCE OF 458.96 TO THE POINT OF BEGINNING.

BENCHMARKS

1.) CHISELED "□" ON TOP OF NORTHWEST CORNER OF WEST WING WALL OF ABANDONED CATTLE GUARD (CONCRETE STRUCTURE). BENCHMARK IS ±8' NORTHEAST OF G.L.O.B.C. 2' BELOW NATURAL GROUND. CORNER SECS. 4, 5, 8 & 9, T-4-S, R-1-E ELEVATION 1240.825.

2.) CHISELED "+" AT SOUTH SIDE OF CONCRETE BASE OF MONITORING WELL AT SOUTHWEST CORNER OF SITE.

3.) CHISELED "+" AT SOUTH SIDE OF CONCRETE BASE OF MONITORING WELL AT WEST SIDE OF SITE.

SHEET INDEX

1. TITLE SHEET
2. EXISTING TOPOGRAPHY & BOUNDARY

PREPARED FOR

GLENN WEINBERGER INC.
3425 SOUTH 43RD AVENUE
PHOENIX, ARIZONA 85009
PHONE (602)278-9155
FAX (602)272-3732

CERTIFICATION

I HEREBY CERTIFY THAT THE "RECORD DRAWING" MEASUREMENTS AS SHOWN HERON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

DATE: 8-15-01

#26837
REGISTRATION NO.

PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26837 G. SCOTT BUCHANAN Date Signed 8-15-01 ARIZONA, U.S.A.

SURVEY BOOK 663
DATE OF SURVEY: 04-12-01

REVISIONS: DATE:

STANLEY CONSULTANTS, INC.
2929 EAST CAMELBACK ROAD, SUITE 130
PHOENIX, ARIZONA 85016 • (602) 912-6500
INTERNATIONAL CONSULTANTS IN ENGINEERING, ARCHITECTURE, PLANNING, AND MANAGEMENT

DES. MRG CKD. GSB/MRG
DRN. AS APP. GSB
DATE: 08-14-01
SHEET 1 of 2
DWG. RAINBOW
PROJ. NO. 13624

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SCALE: 1" = 80'

TOP OF BANK

TOP OF BANK

* FUTURE RIGHT-OF-WAY DEDICATION

*40'

100'

LIMIT OF LANDFILL

N 00°13'29" E

2641.93'

GATE

FD. REBAR

TO STOCKPILES

GATE

GATE

TO MAINTENANCE YARD

CELL 1A

CELL 1B

TOP OF BANK

TOP OF BANK

LIMIT OF LANDFILL

FD. REBAR

TOP OF BANK

TOP OF BANK

100'

55'

* FUTURE RIGHT-OF-WAY DEDICATION.

S 1/4 CORNER SEC 8, T4S R1E

N 89°45'38" W

2270.99'

LEGEND

- DIRECTION OF FLOW
- REBAR
- MONITORING WELL
- FENCE-CHAIN LINK
- FENCE-BARBED WIRE
- DIRT ROAD
- PROPERTY BOUNDARY/ SECTION LINE
- RIGHT-OF-WAY LINE

PROFESSIONAL ENGINEER (CIVIL) 26837 G. SCOTT BUCHANAN Date Signed 8-14-01 ARIZONA, U.S.A.

SURVEY BOOK 663
DATE OF SURVEY: 04-12-01

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INTERNATIONAL CONSULTANTS IN ENGINEERING, ARCHITECTURE, PLANNING, AND MANAGEMENT

DES. MRG CKD. GSB/MRG
DRN. AS APP. GSB
DATE: 08-14-01
SHEET 2 of 2
DWG. RAINBOW
PROJ. NO. 13624

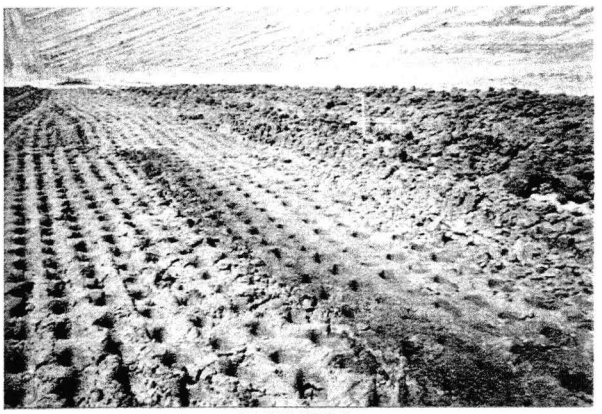
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APPENDIX B

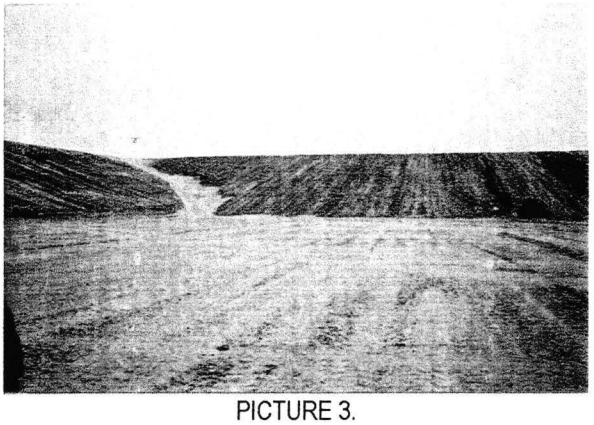
PROJECT SITE PICTURES



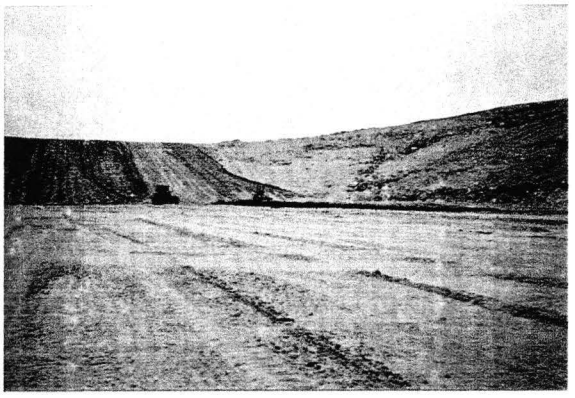
PICTURE 1.
6-inch recompacted soil installation on south slope of Cell 1B. (View from North) 6/26/01



PICTURE 2.
6-inch recompacted soil installation on south slope of Cell 1B. (View from South) 6/26/01



PICTURE 3.
Second 6-inch lift for a total of 12 inches of recompacted soil on south slope. (View from North) 7/12/01



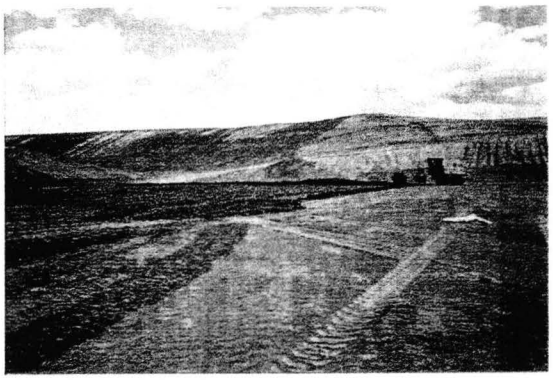
PICTURE 4.
6-inch recompacted soil installation on floor area (western edge). (View from North) 7/12/01



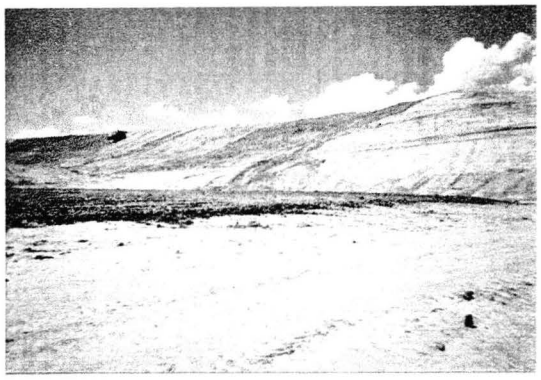
PICTURE 5.
12-inch recompacted soil installed above south slope. (View from West) 7/12/01



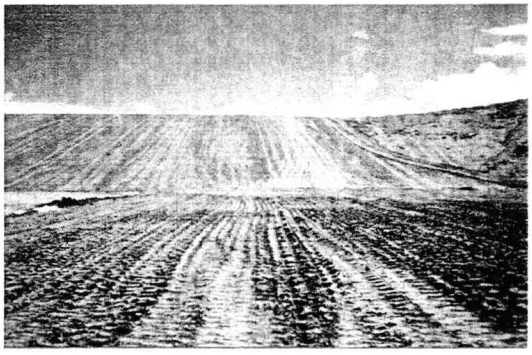
PICTURE 6.
Troxler Surface Moisture Gauge for field tests on 12-inch recompacted soil installation on south slope. 7/19/01



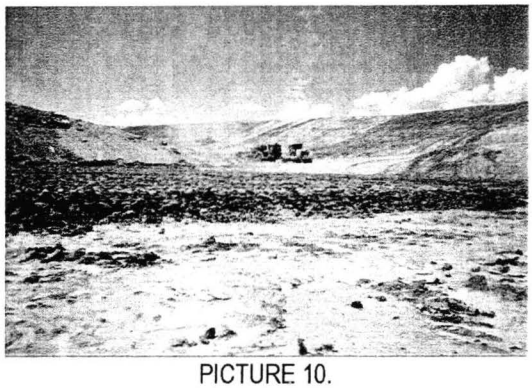
PICTURE 7.
6-inch recompacted soil installation on western half of Cell 1B. (View from Southeast) 7/25/01



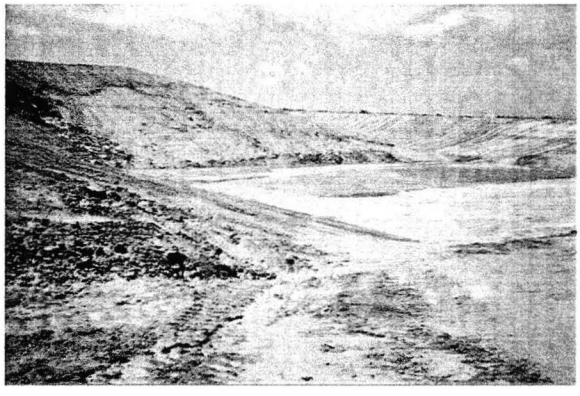
PICTURE 8.
6-inch recompacted soil installed on western half of Cell 1B. Slope in background also shows soil material origin. (View from Southeast) 7/25/01



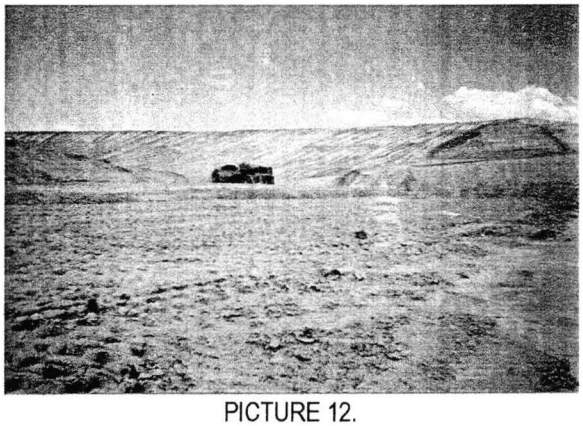
PICTURE 9.
Second 6-inch lift for a total of 12 inches recompacted soil on western half of Cell 1B. (View from North) 8/3/01



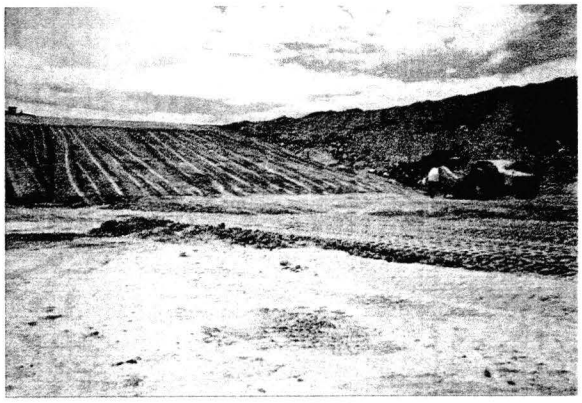
PICTURE 10.
Second 6-inch lift for a total of 12 inches recompacted soil on western half of Cell 1B. Slope in background also shows soil material origin. (View from Southeast) 8/3/01



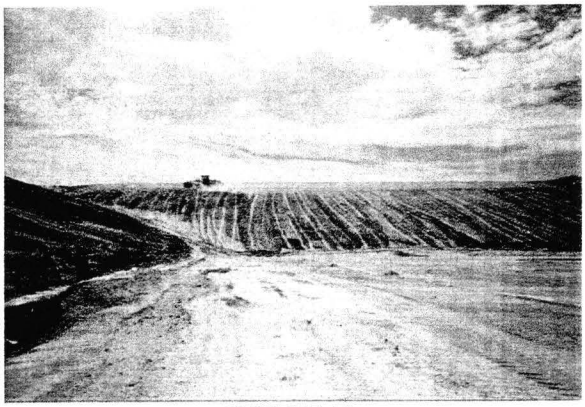
PICTURE 11.
Operations Layer installation on south slope and western half of floor area. (View from Southeast) 8/10/01



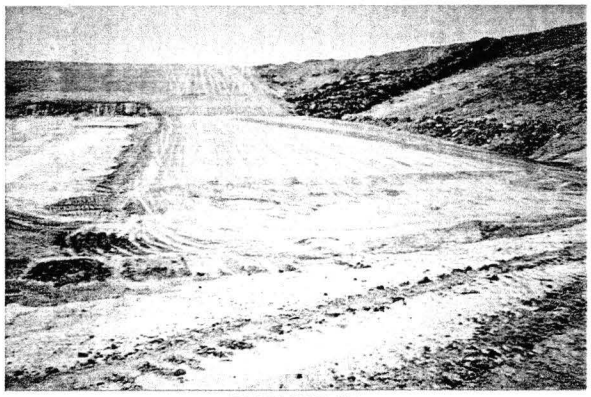
PICTURE 12.
Operations Layer installation on western half of floor area. (View from Southeast) 8/14/01



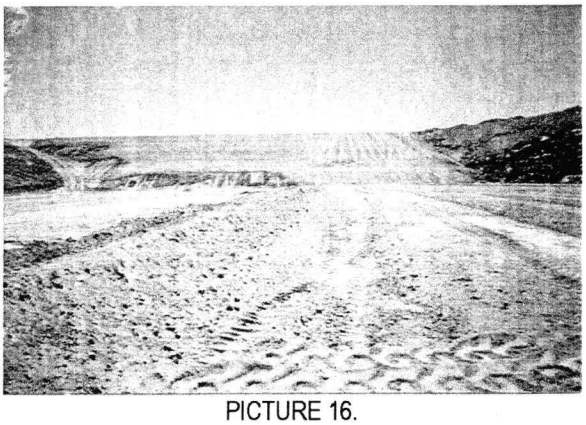
PICTURE 13.
Operations Layer installation on western half of floor area. Also grading of Operations Layer on slope. (View from Northeast) 8/14/01



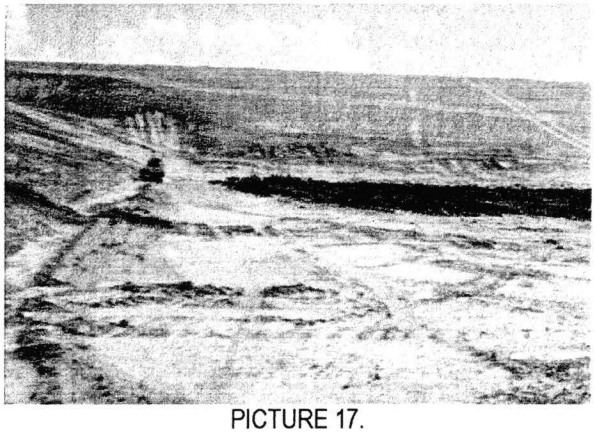
PICTURE 14.
Grading of Operations Layer on south slope. (View from North) 8/14/01



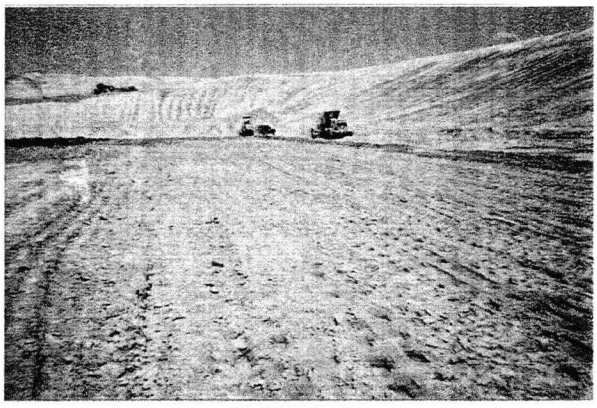
PICTURE 15.
24-inch Operations Layer installed on western half of floor area. (View from North) 9/18/01



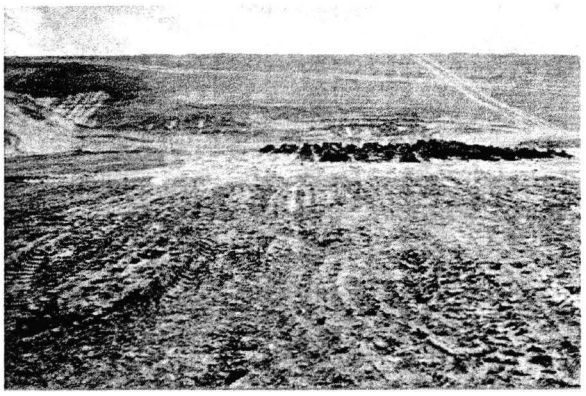
PICTURE 16.
Temporary berm installed at working face of Cell 1B. (View from North) 9/18/01



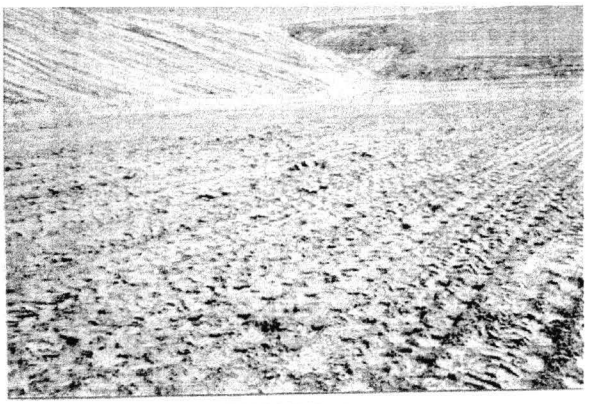
PICTURE 17.
Begin installation of 1st lift of 6-inch recompacted soil on remaining (east) half of Cell 1B. 8/28/01 (View from North)



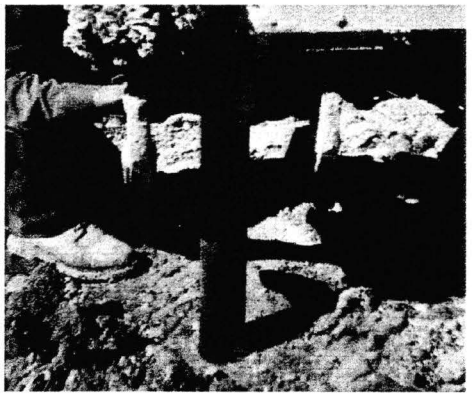
PICTURE 18.
1st lift of 6-inch recompacted soil installation continues on east half of Cell 1B. 8/29/01 (View from South)



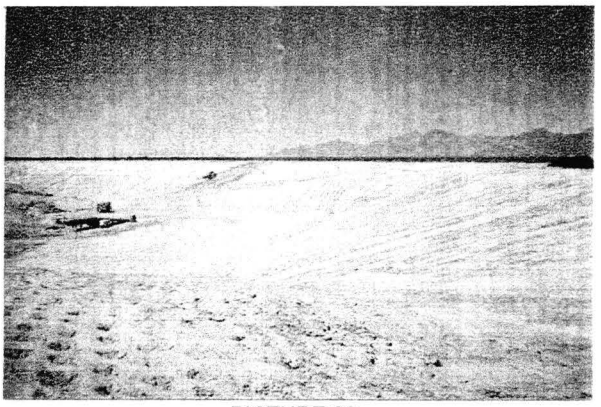
PICTURE 19.
2nd lift of 6-inch recompacted soil installation on east half of Cell 1B. 8/31/01 (View from North)



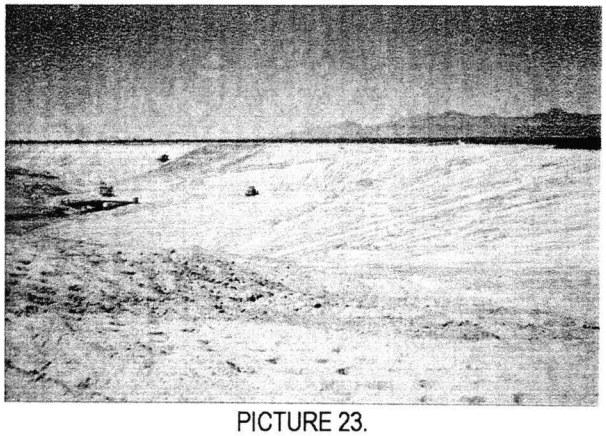
PICTURE 20.
2nd lift completed for a total of 12-inches recompacted soil on east half of Cell 1B. 9/07/01 (View from Northwest)



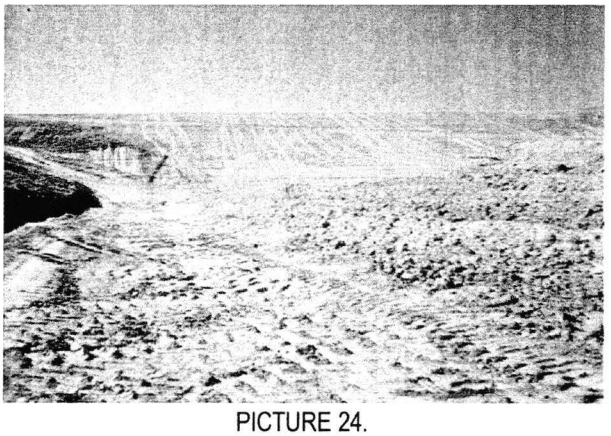
PICTURE 21.
Shelby tube soil sample extraction. 9/07/01



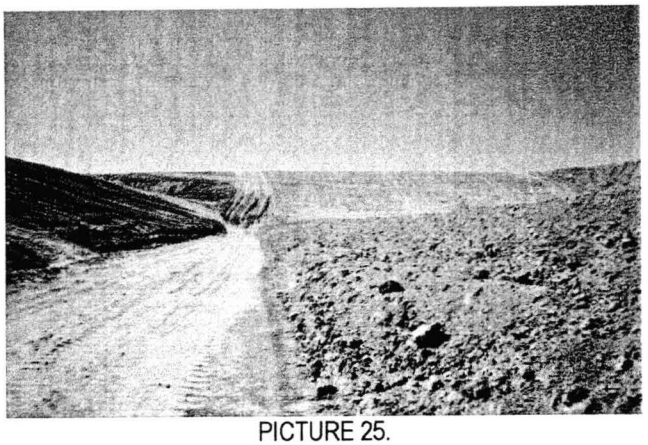
PICTURE 22.
24-inch operations layer installation on east half of Cell 1B. 9/18/01(View from South)



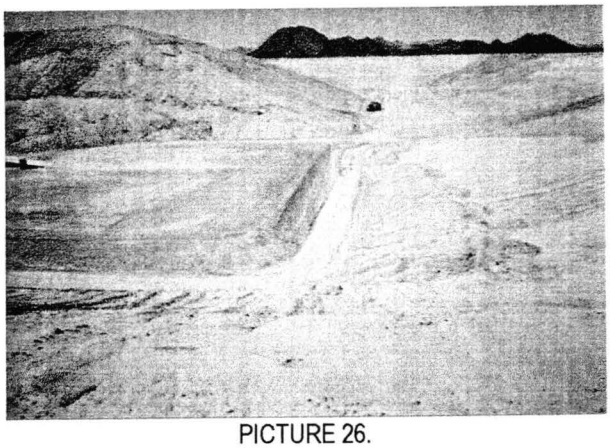
PICTURE 23.
Grading of 24-inch operations layer on east half of Cell 1B. 9/18/01(View from South)



PICTURE 24.
Construction of berm on top of operations layer along eastern edge of Cell 1B. 9/19/01 (View from North)



PICTURE 25.
Finished berm construction along western edge of Cell 1B.
9/21/01 (View from North)



PICTURE 26.
View of Cell 1B Construction. 9/21/01 (View from East)

APPENDIX C

LABORATORY SOIL ANALYSES

ALPHA Geotechnical & Materials, Inc.

PROJECT:	Rainbow Valley Landfill	JOB NO:	01-A-00050
LOCATION:	Maricopa County, AZ	WORK ORDER NO:	3
MATERIAL:	Native	LAB NO:	3
SAMPLE SOURCE:	On-Site	DATE SAMPLED:	09/07/01
SAMPLE PREP:	insitu		

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER
ASTM D5084
METHOD A

AVERAGE PERMEABILITY, cm/sec	6.6E-08
INITIAL LENGTH OF SPECIMEN, in.	4.18
INITIAL DIAMETER OF SPECIMEN, in.	2.88
INITIAL WATER CONTENT, %	19.4
INITIAL DRY UNIT WEIGHT, pcf	95.7
INITIAL VOLUME, cu.in.	27.2
PERMEANT LIQUID	Deaired water
MAGNITUDE OF TOTAL BACK PRESSURE, psi	73
EFFECTIVE CONSOLIDATION STRESS,psi	5
HYDRAULIC GRADIENT USED, in/in	26.5
FINAL LENGTH OF SPECIMEN, in.	4.09
FINAL DIAMETER OF SPECIMEN, in.	2.78
FINAL WATER CONTENT, %	21.7
FINAL DRY UNIT WEIGHT, pcf.	103.8
FINAL VOLUME, cu. in.	24.8
DEGREE OF SATURATION BEFORE TEST, %	71
DEGREE OF SATURATION AFTER TEST,%	97
SPECIFIC GRAVITY USED IN CALCULATIONS OF SATURATION	2.65

TIME INTERVAL (MIN)	K cm/sec	K ft/yr
195	6.91E-08	0.07
172	6.96E-08	0.07
212	6.35E-08	0.07
212	6.35E-08	0.07

ALPHA Geotechnical & Materials, Inc.

PROJECT:	Rainbow Valley Landfill	JOB NO:	01-A-00050
LOCATION:	Maricopa County, AZ	WORK ORDER NO:	3
MATERIAL:	Native	LAB NO:	3
SAMPLE SOURCE:	On-Site	DATE SAMPLED:	08/06/01
SAMPLE PREP:	Insitu		

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER ASTM D5084 METHOD A

AVERAGE PERMEABILITY, cm/sec	1.3E-07
INITIAL LENGTH OF SPECIMEN, in.	4.04
INITIAL DIAMETER OF SPECIMEN, in.	2.88
INITIAL WATER CONTENT, %	12.6
INITIAL DRY UNIT WEIGHT, pcf	106.2
INITIAL VOLUME, cu.in.	26.2
PERMEANT LIQUID	Deaired water
MAGNITUDE OF TOTAL BACK PRESSURE, psi	73.5
EFFECTIVE CONSOLIDATION STRESS,psi	5
HYDRAULIC GRADIENT USED, in/in	20.6
FINAL LENGTH OF SPECIMEN, in.	4.01
FINAL DIAMETER OF SPECIMEN, in.	2.84
FINAL WATER CONTENT, %	18.7
FINAL DRY UNIT WEIGHT, pcf.	109.3
FINAL VOLUME., cu. in	25.4
DEGREE OF SATURATION BEFORE TEST, %	60
DEGREE OF SATURATION AFTER TEST,%	97
SPECIFIC GRAVITY USED IN CALCULATIONS OF SATURATION	2.65

TIME INTERVAL (MIN)	K cm/sec	K ft/yr
76	1.27E-07	0.13
85	1.37E-07	0.14
76	1.27E-07	0.13
76	1.27E-07	0.13

ALPHA Geotechnical & Materials, Inc.

PROJECT:	Rainbow Valley Landfill	**JOB NO:**	01-A-00050
LOCATION:	Maricopa County, AZ	**WORK ORDER NO:**	2
MATERIAL:	Native	**LAB NO:**	2
SAMPLE SOURCE:	On-Site	**DATE SAMPLED:**	07/09/01
SAMPLE PREP:	Insitu		

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER ASTM D5084 METHOD A

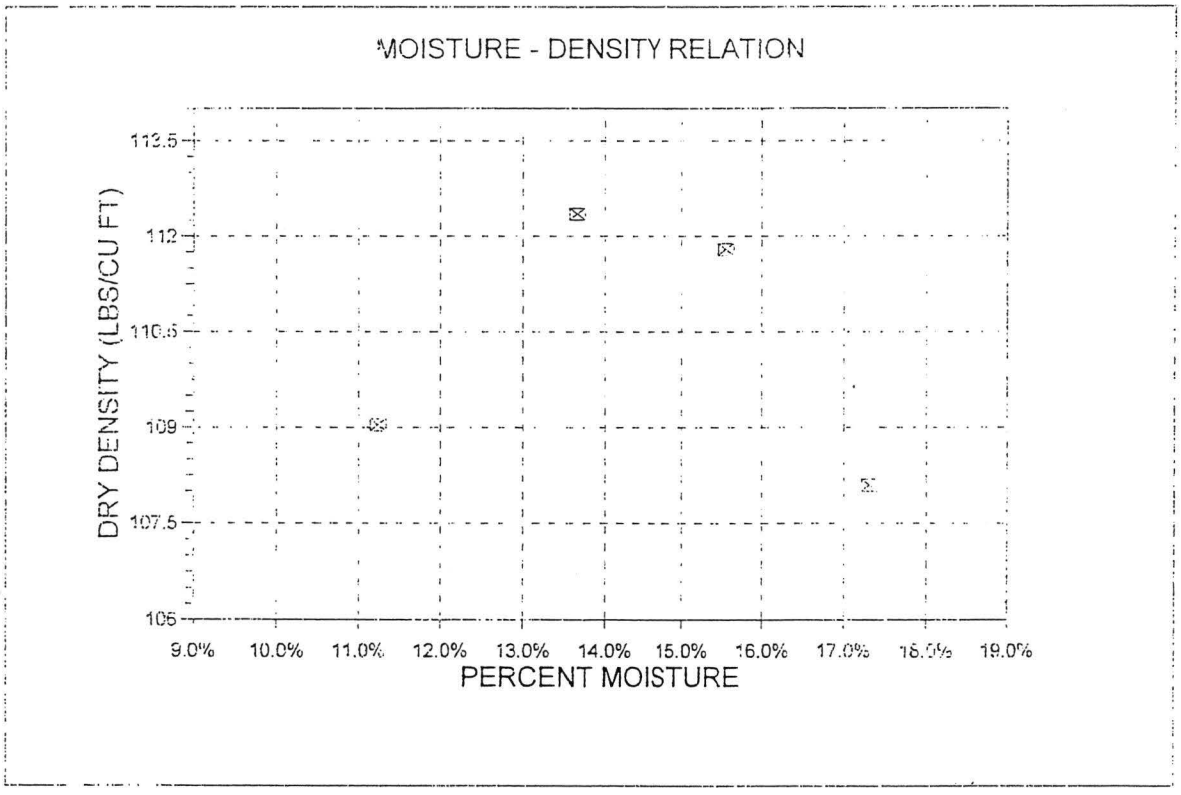
AVERAGE PERMEABILITY, cm/sec	1.7E-07
INITIAL LENGTH OF SPECIMEN, in.	4.15
INITIAL DIAMETER OF SPECIMEN, in.	2.88
INITIAL WATER CONTENT, %	10.9
INITIAL DRY UNIT WEIGHT, pcf	105.9
INITIAL VOLUME, cu.in.	26.9
PERMEANT LIQUID	Deaired water
MAGNITUDE OF TOTAL BACK PRESSURE, psi	73
EFFECTIVE CONSOLIDATION STRESS,psi	5
HYDRAULIC GRADIENT USED, in/in	26.7
FINAL LENGTH OF SPECIMEN, in.	4.15
FINAL DIAMETER OF SPECIMEN, in.	2.83
FINAL WATER CONTENT, %	20.1
FINAL DRY UNIT WEIGHT, pcf.	107.9
FINAL VOLUME, cu. in.	26.1
DEGREE OF SATURATION BEFORE TEST, %	51
DEGREE OF SATURATION AFTER TEST,%	100
SPECIFIC GRAVITY USED IN CALCULATIONS OF SATURATION	2.65

TIME INTERVAL (MIN)	K cm/sec	K ft/yr
60	1.74E-07	0.18
90	1.66E-07	0.17
60	1.74E-07	0.18
63	1.66E-07	0.17

PROJECT:	RAINBOW VALLEY LANDFILL	JOB NO:	01-A-00050
LOCATION:	MARICOPA COUNTY AZ	WORK ORDER NO:	1
MATERIAL:	NATIVE	LAB NO:	1
SAMPLE SOURCE:	ON-SITE	DATE SAMPLED:	05/09/01

MOISTURE DENSITY RELATION
ASTM D698

MAXIMUM DRY DENSITY	112.5 PCF	METHOD	A
OPTIMUM MOISTURE CONTENT	14.4%	CURVE	A



PROJECT:	Rainbow Valley Landfill	JOB NO:	01-A-00050
LOCATION:	Maricopa County, AZ	WORK ORDER NO:	1
MATERIAL:	Native	LAB NO:	1
SAMPLE SOURCE:	On-Site	DATE SAMPLED:	05/09/01
SAMPLE PREP:	95% of Max @ 2% Below Optimum		

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER
ASTM D5084
METHOD A

AVERAGE PERMEABILITY, cm/sec	4.2E-06
INITIAL LENGTH OF SPECIMEN, in.	4.56
INITIAL DIAMETER OF SPECIMEN, in.	4.00
INITIAL WATER CONTENT, %	12.5
INITIAL DRY UNIT WEIGHT, pcf	106.6
INITIAL VOLUME, cu.in.	57.3
PERMEANT LIQUID	Deaired water
MAGNITUDE OF TOTAL BACK PRESSURE, psi	74.5
EFFECTIVE CONSOLIDATION STRESS,psi	5
HYDRAULIC GRADIENT USED, in/in	6.1
FINAL LENGTH OF SPECIMEN, in.	4.58
FINAL DIAMETER OF SPECIMEN, in	4.02
FINAL WATER CONTENT, %	21.7
FINAL DRY UNIT WEIGHT, pcf.	104.9
FINAL VOLUME, cu. in.	58.1
DEGREE OF SATURATION BEFORE TEST, %	60
DEGREE OF SATURATION AFTER TEST,%	100
SPECIFIC GRAVITY USED IN CALCULATIONS OF SATURATION	2.65

TIME INTERVAL (MIN)	K cm/sec	K ft/yr
15	4.29E-06	4.44
15	4.29E-06	4.44
15	4.29E-06	4.44
15	4.06E-06	4.20

PROJECT:	RAINBOW VALLEY LANDFILL	JOB NUMBER:	01-A-00050
LOCATION:	MARICOPA COUNTY, AZ	WORK ORDER NO:	1
MATERIAL:	NATIVE	LAB NO:	1
SAMPLE SOURCE:	ON-SITE	DATE SAMPLED:	05/09/01

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)
ATTERBERG LIMITS (ASTM D4318)

MECHANICAL ANALYSIS

SIEVE SIZE	% PASSING	ATTERBERG LIMITS
6 IN	100	
4 IN	100	LL: 31
3 IN	100	PI: 11
2 IN	100	
1 1/2 IN	100	
1 IN	100	
3/4 IN	100	
1/2 IN	100	
3/8 IN	100	
1/4 IN	99	
#4	99	
#8	95	
#10	94	
#16	89	
#30	80	
#40	73	
#50	66	
#100	53	
#200	40	

Grain Size Analysis/Atterberg Test Results

Rainbow Valley Landfill

Sample #1	
Sieve No.	**% Passing**
4	100
8	99
16	99
30	98
50	97
100	51
200	48

Liquid Limit = 32
Plasticity Index = 12

Sample #2	
Sieve No.	**% Passing**
4	100
8	99
16	99
30	99
50	98
100	53
200	51

Liquid Limit = 36
Plasticity Index = 14

Sample #3	
Sieve No.	**% Passing**
4	100
8	99
16	99
30	98
50	98
100	56
200	44

Liquid Limit = 40
Plasticity Index = 17

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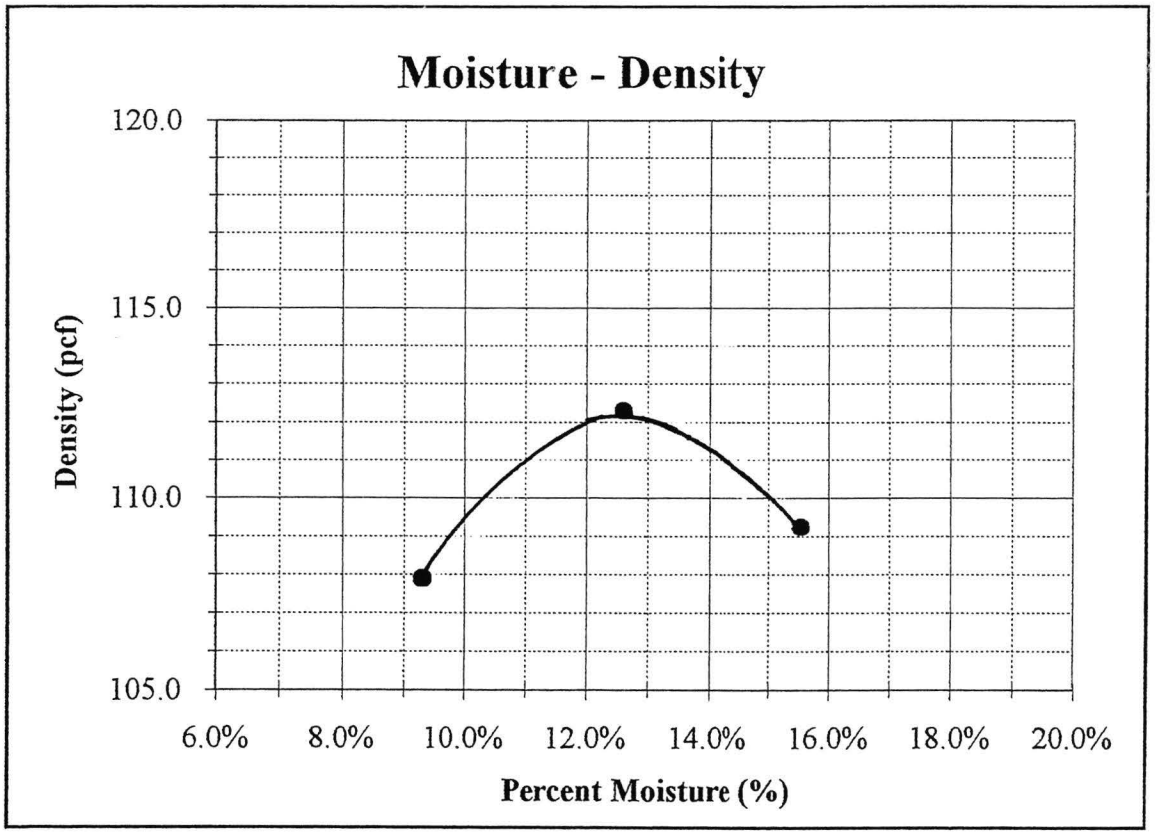
Laboratory Moisture Density - ASTM D698

Date: 6-Aug-01 Soil description: Clayey Sand (SC), Fine Grained, Brown
Project: Rainbow Valley Landfill Project Number: PX 1001001.04
Glenn Weinberger, Inc. Collected: Sample #1
Collected by: AEM

Wmold = 4.458 Lbs

Trial	Weight of full mold (Lbs)	Weight of soil (wet) (Lbs)	Water Content: Container + wet sample (Lbs)	Water Content: Container + dry sample (Lbs)	Mdry (Lbs)	w (%)	wet unit weight (pcf)	dry unit weight (pcf)
1			1.892	1.730	1.730	9.4%	118.3	108.1
2			2.023	1.750	1.750	15.6%	126.5	109.4
3			2.021	1.795	1.795	12.6%	126.3	112.2
4								
5								
6								
7								

Optimum Moisture Content: 12.6 (%)
Maximum Desity: 112.2 (pcf)



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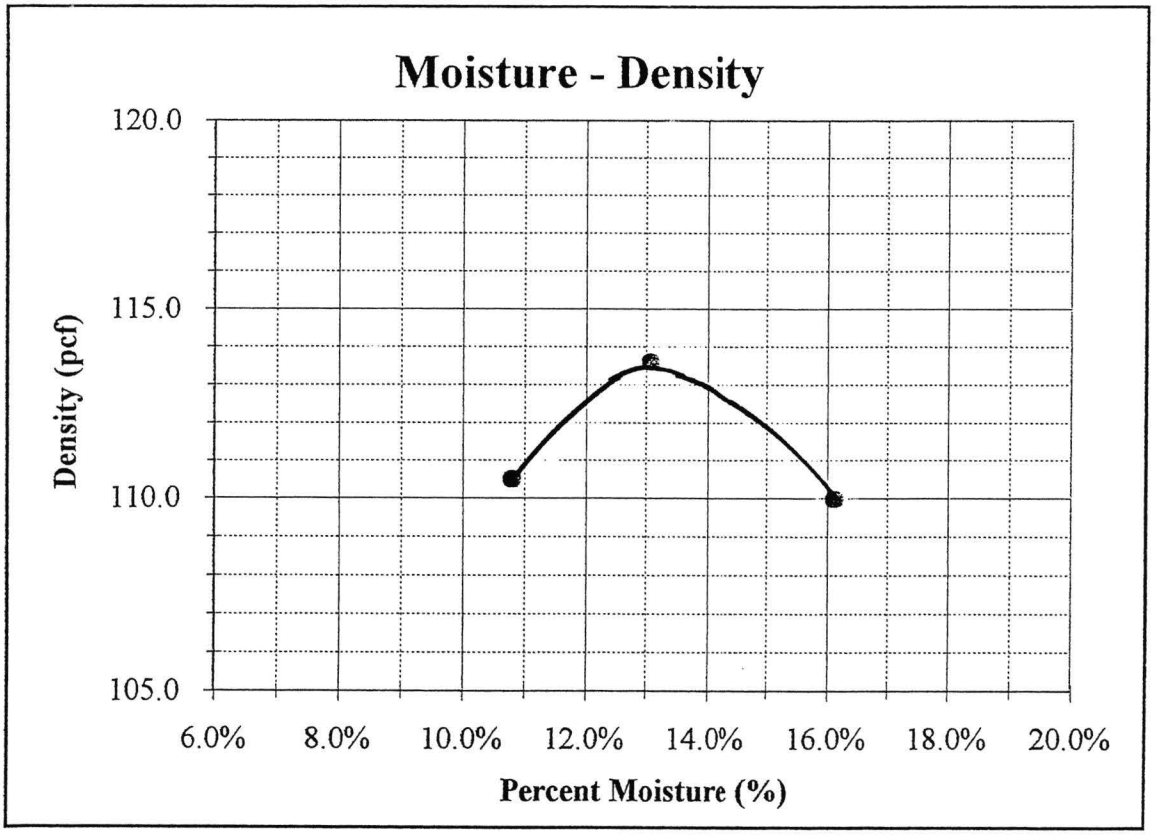
Laboratory Moisture Density - ASTM D698

Date: 6-Aug-01 Soil description: Clayey Sand (SC), Fine Grained, Brown
Project: Rainbow Valley Landfill Project Number: PX 1001001.04
Glenn Weinberger, Inc. Collected: Sample #2
Collected by: AEM

Wmold = 4.458 Lbs

Trial	Weight of full mold (Lbs)	Weight of soil (wet) (Lbs)	Water Content: Container + wet sample (Lbs)	Water Content: Container + dry sample (Lbs)	Mdry (Lbs)	w (%)	wet unit weight (pcf)	dry unit weight (pcf)
1			1.957	1.766	1.766	10.8%	122.3	110.4
2			2.059	1.822	1.822	13.0%	128.7	113.9
3			2.043	1.760	1.760	16.1%	127.7	110.0
4								
5								
6								
7								

Optimum Moisture Content: 13 (%)
Maximum Desity: 113.9 (pcf)



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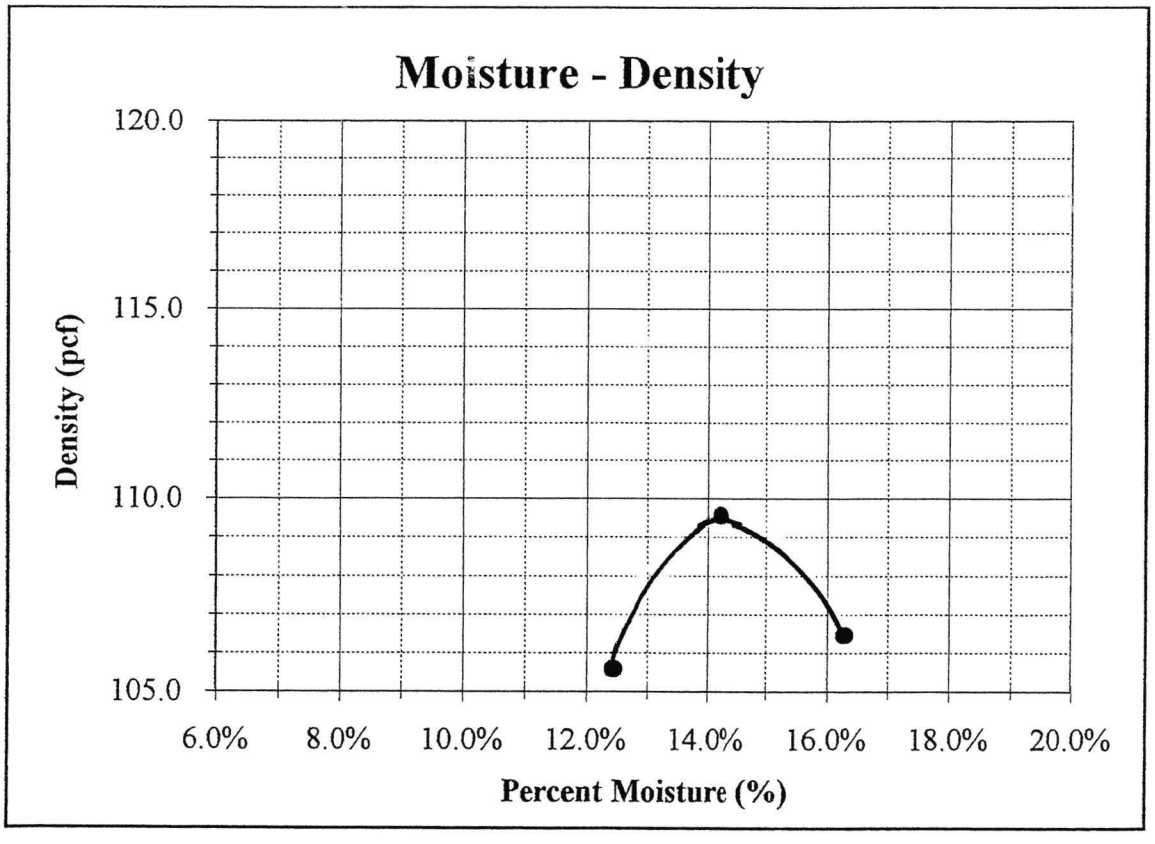
Laboratory Moisture Density - ASTM D698

Date: 6-Aug-01 Soil description: Clayey Sand (SC), Fine Grained, Brown
Project: Rainbow Valley Landfill Project Number: PX 1001001.04
Glenn Weinberger, Inc. Collected: Sample #3
Collected by: AEM

Wmold = 4.458 Lbs

Trial	Weight of full mold (Lbs)	Weight of soil (wet) (Lbs)	Water Content: Container + wet sample (Lbs)	Water Content: Container + dry sample (Lbs)	Mdry (Lbs)	w (%)	wet unit weight (pcf)	dry unit weight (pcf)
1			1.901	1.694	1.694	12.2%	118.8	105.9
2			2.005	1.755	1.755	14.2%	125.3	109.7
3			1.984	1.706	1.706	16.3%	123.0	106.6
4								
5								
6								
7								

Optimum Moisture Content: 14.2
Maximum Desity: 109.7 (pcf)



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APPENDIX D

PROJECT DOCUMENTATION

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FIELD FORM

Project No: PX-1001.001.04 **Project Name:** Cell 1B Construction
Location: Rainbow Valley Landfill

Date: 09-19-01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear Working Areas

Equipment Used: Grader

Field Notes: Site visit w/ SSA. Operations Layer complete and graded. Berm for stormwater control is installed at east boundary and north boundary of Cell 1B. (Berm is approx. 1.5' height, ~1' wide). Backside grading of ops layer and excavated area is still unfinished. Operator will finish that today.
SSA suggests that markers for liner boundary be installed for future reference. Operator also says he confirmed height of ops layer with laser level.

Leak $\times 10^{-8}$ cm/sec (ALPHA Num. #)

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Construction

Location: Rainbow Valley Landfill

Date: 09-18-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear Working Areas

Equipment Used: Scraper, Grader

Field Notes: Remaining areas of Cell 1B has 2' operations layer installed. Grading of the entire area is also complete. Operator will inspect for any 'low' spots and fill accordingly. Also berm installation to begin at east and north boundaries of Cell 1B.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 09-17-01

Form Completed by: TML

Weather Conditions: Sunny, Clear, occasional light wind

Site Conditions: Clear working areas

Equipment Used: Scraper, Grader

Field Notes: Approximately 75% of remaining floor area has 2' of operations layer.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 13 SEP 01

Form Completed by: TML

Weather Conditions: Breezy, Cloudy, Fewer than Occasional light rain

Site Conditions: Clear working areas

Equipment Used: (1) Scraper, Grader, Water Truck

Field Notes: 3½" of operations layer installed over remaining east half of landfill floor area. Scraper is at half capacity due to mechanical problems.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 09-10-01

Form Completed by: TML

Weather Conditions: Sunny, Slight Breeze

Site Conditions: Clear Working Areas

Equipment Used: (1) Scraper, Grader

Field Notes: Installation of operations layer (24") has begun and will continue to proceed until complete.

Landfill Supervisor acknowleges berm construction for stormwater drainage control.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 09-07-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear Working Areas

Equipment Used: ~~Scraper~~ Grader

Field Notes: Final Installation of 12" Recompacted Soil (Liner) installed over remaining (east half) floor area.
TML & AEM on site for field tests and sampling.
4 field tests for compaction and moisture and
1 shelby tube sample taken for permeability analysis.
Field tests show passing compaction quality and moisture levels.
Notified supervisor to begin operations layer (24") installation.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 09-05-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear workikey areas.

Equipment Used: Dozer, Water Truck, Scrapers, Grader, Compactor

Field Notes: Arrive @ site @ 11:30am. Installation of wet soil mix for compaction compacted soil continues. Approximately 50% of remaining area has 1-ft compacted soil installed. (south end)

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 08-31-01

Form Completed by: TML

Weather Conditions: Sunny, Few Clouds

Site Conditions: Clear Working Areas

Equipment Used: Scrapers, Grader, Compactor, Dozer, Water Truck

Field Notes: Soil Liner Installation continues. About ~~X~~ 50% of remaining floor area has 12" liner installed.
Compactor passes average 8-10 over area.
Visual Observ of soil install, looks good. No cracks. Operator will apply water to prevent over-drying and cracking of finished areas.
Soil tests expected by Wednesday or Thursday.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 29 AUG 01

Form Completed by: TML

Weather Conditions: Sunny, Very Few Clouds

Site Conditions: Clear working areas.

Equipment Used: (2) Scraper (belly-dump), grader, compactor, dozer Ingersoll Rand 70

Field Notes: Approximately 80% of remaining area has a 6" compacted soil layer installed. Visual walk-through conducted, no visible large cracks, but will have operator spray water on areas of first install to prevent any drying and cracking.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 08-27-01

Form Completed by: TML

Weather Conditions: Sunny

Site Conditions:

Equipment Used:

Field Notes: Mixed Soil/Water material is too wet to effectively work with. Will continue mixing today. Will start placement again tomorrow.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 08-2-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear working area.

Equipment Used: Scraper, Grader, Dozer, Water Truck, Compactor

Field Notes: A second area of which a 6" lift of soil-water mixture was placed (next to ~~adjacent~~ 1st working area) This area will be graded then compacted.

~~#~~ East half of Cell 1B has a 6" scarified/recompacted soil layer on approxiamately 50% of entire area.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 08-24-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear Working Areas

Equipment Used: (both belly-dump) CAT 621F Scraper, (2)

Field Notes: 1400 hrs Beginning placement of 1st lift of recompacted/scarified soil layer today. Construction begins at southwestern corner of remaining cell 1B.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 08-23-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear working areas.

Equipment Used:

Field Notes: No progress on soil (compacted) layer installation today. Soil preparation (mixing with water) today and tomorrow morning for placement of east half of Cell 1B. → should progress tomorrow.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 08-22-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear Working Area.

Equipment Used: CAT 621F Scraper

Field Notes: Survey markers re-set on slope areas.
Tipper from Cell 1A moved to working area of Cell 1B, (west half).
No progress of recompacted/scarified soil layer today.
Soil material was excavated and placed on mixing area (north of Cell 1) for preparation.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 15 AUG 01 **Form Completed by:** TML

Weather Conditions: Sunny, Few Clouds

Site Conditions: Clear Working Areas, Previous muddy areas now drying out.

Equipment Used: Scraper, Grader

Field Notes: 2' Operations layer installed on West half of floor area of Cell 1B. Temporary berm also installed on east and north edges of installation area. Ht ~ 1.5' - 2' in height. (final) Grading of operations layer on slope and floor continues. Markers to be installed tomorrow.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 08-14-01 **Form Completed by:** TML

Weather Conditions: Sunny, Partly Cloudy afternoon

Site Conditions: Clear Working areas.

Equipment Used: GD650A KOMATSU (Grader), Scraper (Belly Dump)

Field Notes: Spoke w/ Greg Weinberger on 8/13/01. Mixing (mud) for liner installation on east half of floor area. To be installed over the next two days 8/14- 8/15. ~~Installed~~ Installation of liner has not begun yet.

The two foot operations layer installation continues at the floor area. Installation will continue tomorrow. Spoke w/ Greg W. 8/14 at RVLF site.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 10 AUG 01 **Form Completed by:** TML

Weather Conditions: Partly Cloudy

Site Conditions: Standing/Ponding water everywhere, some areas muddy after morning rains.

Equipment Used:

Field Notes: Preliminary results of permeability tests received and operator notified to begin installation of operations layer of the ½ (west half) floor area. Also operator will build temporary stormwater berm at working face of liner installation (at east edge of 'west half') to ensure proper drainage.

Morning rains caused areas of landfill to pond water and roads are muddy, etc. Very little progress on operations layer installation due to muddy conditions.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 08 AUG 01 **Form Completed by:** TML

Weather Conditions: ~~Sunn~~ @ Cloudy

Site Conditions: Clear working areas

Equipment Used: Scrapers, Blade, Dozer

Field Notes: Installation of operations layer on south slope continues. Approximately 70% of south slope is covered with @ least 1 foot.

Awaiting test results for samples taken on west half of floor area, should be done tomorrow. Will begin installation of operations layer as soon as tests results show @ least 95% compaction and permeability is @ 1.0×10^{-5} cm/sec. (least)

Also notified operator that a temporary berm must be installed prior to continuing landfill operations (after ops layer installation) on floor area. Berm is to prevent 'clean' stormwater and landfill stormwater from mixing and to keep landfill stormwater from reaching excavated east half of floor area.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 06 AUG 01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear

Site Conditions: Clear Working Areas

Equipment Used: Scraper, Blade, Dozer (D-9)
(633 - belly dump)

Field Notes: Conducted Soil Sampling / Testing today on West Half of Landfill floor/base area. Took four Nuclear density/moisture tests and obtained 1 shelby tube sample. Sampler/Tester was Alan Money & Tamara Long. Took sample to Alpha for perm & moisture tests.

South slopes is currently being covered with 1 foot (1st lift) native soil for operations layer. Approximately 50% of south slope is covered with 1 foot soil for operations layer.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 03 AUG 01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear

Site Conditions: clear working areas

Equipment Used: Dozer, Scraper, Grader, Water Truck, Compactor

Field Notes: ½ of floor area is now covered with 12" compacted soil. Ready for soil testing. Lots of progress today. sketch on back. Visual inspection shows no damage or cracks.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 02 AUG 01 **Form Completed by:** TML

Weather Conditions: Sunny, Few Cloads

Site Conditions: No changes, clear working areas.

Equipment Used: Dozer, Scraper, Compactor, Grader, Water Truck.

Field Notes: 1/4 of floor area now has 12" compacted soil. 1/2 of floor area (including ↗) has at least 6" compacted soil. Remaing 1/2 of floor area should have 2nd lift by Monday (goal). Soil testing immediately thereafter.
No progress on Monday through Wednesday due to non-working equipment.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 30 JULY 01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear

Site Conditions: Ponding Water everywhere due to overnight storm. Plenty of wet areas in landfill area.

Equipment Used:

Field Notes: Equipment breakdown on Saturday. Equipment to be repaired today and probably tomorrow. No progress on liner construction today.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 27 July 01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear, Wind ~5-8 mph

Site Conditions:

Equipment Used: Compactor, Blade, Scraper, Water Truck, Dozer

Field Notes: 2nd lift installation of floor liner begins.
~30% of 1st half of floor has 2nd lift installed
Visual inspection by walkthrough shows no damaged areas or cracks.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 07-25-01 **Form Completed by:** TML

Weather Conditions: Partly Cloudy

Site Conditions: Dry, No Changes.

Equipment Used: Grader, Scraper, Dozer, Water Truck, Compactor

Field Notes: Over West half of floor, 1st lift (6" compacted soil) is ~ 80% complete.

Operator reports that slope has been watered at least once a day and usually twice a day. Also, areas ~~with~~ where 1st lift completed on floor has been watered as well. So as to ~~not~~ prevent cracking of the soil liner. Visual inspection of installed soil on floor shows no damaged areas or cracks.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 20 July 01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear, Few Clouds

Site Conditions:

Equipment Used: Water Truck, Compactor, ~~Dozer~~, Grader, Scraper

Field Notes: Operator will apply water to slope twice a day to keep some moisture to prevent cracking. Operations layer will be constructed once test results are in and are acceptable.

Very little progress today on liner construction due to mixture being too 'muddy'.

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Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 19 July 01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear

Site Conditions:

Equipment Used:

Field Notes: Due to landfill equipment breaking down. (compactor) no work on liner today.

Plastic strip is in place over a test area. CQA testing done on slope by TML & AEM. Also took soil sample in a shelby tube for permeability testing and moisture analysis.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 16 July 01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear

Site Conditions:

Equipment Used:

Field Notes: TML & SSA on-site.

Not much progress today. Compactor is not working. SSA suggests to Operator to cover existing liner lifts with plastic to prevent drying and cracking. Operator says compactor should be working tomorrow or Wed. TML will call for update on Tues. Operator also will put plastic on constructed liner.

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FIELD FORM

Project No: PX – 1001.001.04

Project Name: Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 13 July 01

Form Completed by: TML

Weather Conditions: Sunny, Few Clouds

Site Conditions:

Equipment Used: Scraper, Water Truck, Compactor, Dozer, Blade

Field Notes: Installation of 1st lift on cell floor continues, approximately a 40' x 80' strip now completed. Visual inspection of installed soil areas shows no damaged areas or cracks.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 12 July 01 **Form Completed by:** TML

Weather Conditions: Mostly Cloudy

Site Conditions:

Equipment Used: Scraper, Blade, Water Truck, Dozer, Compactor

Field Notes: 2nd lift completed on south slope. 1st lift construction begins on landfill floor/base at the southwest corner. Compactor repaired and is returned to use. Visual inspection of entire south slope shows no damaged areas or cracks.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 10 JULY 01 **Form Completed by:** TMC

Weather Conditions: Sunny, Partly Cloudy

Site Conditions:

Equipment Used: Water Truck, Blade, Compactor, Scrapers, Dozer

Field Notes: Continue installation of 2nd lift on south sideslope of Cell 1B. Compactor broke down, needs repair.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 09 JULY 01 **Form Completed by:** TML

Weather Conditions: Mostly Cloudy

Site Conditions:

Equipment Used: Scraper, Compactor, Dozer, Water Truck, Blade

Field Notes: 12" (2nd 6" lift) ~75% completed installation on south sideslope of Cell 1B. ~1:00pm. Visual inspection shows no signs of damaged areas or cracks.

Note: Heavy rains delayed operations on Friday 7/6/01.
Operations continued 7/9/01.

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Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 05 JUL 01 **Form Completed by:** TML

Weather Conditions: Partly Cloudy, Breezy

Site Conditions:

Equipment Used: Water Truck, Blade, Scraper, Dozer

Field Notes: Small strip of 2nd lift installed today @ SW corner of cell. Little progress made today due to additional work needed @ the existing active cell 1A. Visual inspection of installed lifts show no damaged areas or cracks.

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FIELD FORM

Project No: PX – 1001.001.04 **Project Name:** Cell 1B Compacted Soil Layer (Liner) Installation

Location: Rainbow Valley Landfill

Date: 07-03-01 **Form Completed by:** TML

Weather Conditions: Sunny, Partly Cloudy,

Site Conditions:

Equipment Used: Water Truck, Scraper, Dozer, Blade, Compactor

Field Notes: Two 'strips' of (2nd) 6-inch lift of compacted soil is installed near Southeast corner of Cell 1B. Progress will continue in an easterly direction until entire slope is completed.

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FIELD FORM

Project No: PX-1001.001.04 **Project Name:** Rainbow Valley Landfill (Cell 1B Liner Install.)

Location: Rainbow Valley Landfill

Date: 07-02-01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear Temp. ~115°

Site Conditions:

Equipment Used: Water Truck, Scraper, Compactor, Blade

Field Notes: 1:00pm - 1st lift (6-inch compacted layer) is completed on south sideslope. Next step, 2nd lift (6-inch compacted layer) will be installed on sideslope. Visual inspection (via walkthrough) showed no damaged areas or cracks in the installed 1st lift on the south sideslope.

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FIELD FORM

Project No: PX 1001.001.01

Project Name: Rainbow Valley Landfill Cell 1B Liner Install

Location: Rainbow Valley Landfill

Date: 06/29/01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions:

Equipment Used: Water Truck, Blade, Scraper, Dozer, Compactor

Field Notes: Scraper now appears operable. Soil Liner installation continues. Visual inspection (by walking) show no signs of damaged areas or cracks on installed lifts on south slope.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Rainbow Valley Landfill (Cell 1B Liner Install)

Location: Rainbow Valley Landfill

Date: 6-28-01

Form Completed by: TML.

Weather Conditions: Sunny, Clear, no wind ~temp° 110

Site Conditions:

Equipment Used:

Field Notes: Operator reports ~~pbs~~ problems with scraper.
No work activities today. Should be fixed shortly.

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FIELD FORM

Project No: RX-1008.001.01

Project Name: Rainbow Valley Landfill (Cell 1B)

Location: Rainbow Valley Landfill

Date: 06-27-01

Form Completed by: TML

Weather Conditions: Sunny, Clear, little or no wind.

Site Conditions:

Equipment Used: Water Truck, blade, Scraper, Compactor

Field Notes: 12:55 - Day's landfill liner (compacted soil) installation begins.
Approximately 12' wide strip was placed on slope. (Took approximately 4 loads of soil)
Scraper passes > 5 times (back & forth)
Compactor passes > 8 times (back & forth)
More passes were done over areas that were uneven and as needed.

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FIELD FORM

Project No: PX 1001.001.04

Project Name: Rainbow Valley Landfill (Cell 1B Liner Install.)

Location: Rainbow Valley Landfill

Date: 06-26-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions:

Equipment Used:

Field Notes: 12:30pm. Operator reports problems with water truck yesterday which halted lining operations. Today, truck is fixed, but liner installation operations will continue dependent on the amount of water-soil mixture that can be made and installed. Expecting a short amount of progress today. Liner operations will continue tomorrow. Visual inspection (via walkthrough) showed no signs of damaged areas or cracks.

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FIELD FORM

Project No: PX 1001.001.04 **Project Name:** Rainbow Valley Landfill (Cell 1B Liner Install)

Location: Rainbow Valley Landfill

Date: 6-21-01 **Form Completed by:** TML

Weather Conditions: Sunny, Clear

Site Conditions: No significant changes.

Equipment Used: Water Truck, Scraper, Blade, Compactor

Field Notes: 12:30pm - Compacted Soil Layer (Liner) continues to be installed. Two operators currently on project. Visual walkthrough of south slope, ~6" compacted soil layer is installed from existing ground level to bottom (floor) area. Good coverage. No visible cracks or damage.

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FIELD FORM

Project No: PX-1001.001.04

Project Name: Rainbow Valley Landfill (Cell 1B)

Location: Rainbow Valley Landfill

Date: 6-20-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: No significant changes from 6/18/01.

Equipment Used: Water Truck, Scraper, Blade, Compacter

Field Notes: 1:00pm - TML & SSA on-site.
Operator reports no landfill liner work completed on 6/19/01 due to non-working blade.
Confirmed with operation that 12" recompacted soil liner is ~~being~~ to be installed.
Operator also verbally confirms ~4-8 passes with blade and ~4-8 passes with compacter is being acheived. Currently a 6" compacted soil layer is installed over a portion of the south slope.

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FIELD FORM

Project No: PX-1001.001.01

Project Name: Rainbow Valley Landfill (Cell 1B)

Location: Rainbow Valley Landfill

Date: 6-18-01

Form Completed by: TML

Weather Conditions: Sunny, Clear

Site Conditions: Excavation complete, 12" Soil Layer Installed, Survey markers set.

Equipment Used: Water Truck, Scraper / Spreader, Blade, Compactor (Sheeps Foot)

Field Notes: 1:55 pm Installation of compacted soil liner begin on south west corner sideslope. Soil-water mixing area is north of excavated landfill. During observation, landfill perimeter roads watered at intervals. ~ 6-10 passes with blade, ~ 6-10 passes with compactor. Compacted soil liner installation to begin at slopes, then will proceed to floor area.

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File Divider Page

100299

Project 90-275-01
June 1991

Canonie Environmental

Report

Water Quality Data Evaluation

Hermit Mine Site
Fredonia, Arizona

Prepared for:

Energy Fuels Nuclear, Inc.
Denver, Colorado

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Hermit Mine Clean Closure
International Uranium (USA) Corp
Energy Fuels Nuclear, Inc.
Inventory #100299

Report

Water Quality Data Evaluation

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WATER QUALITY DATA EVALUATION
HERMIT MINE SITE

1.0 INTRODUCTION

Canonie Environmental Services Corp. conducted a water quality data evaluation for Energy Fuels Nuclear, Inc.'s (EFN) Hermit Mine site in Fredonia, Arizona. The purpose of the evaluation was to determine potential causes of unanticipated exceedances of ground water quality standards for water samples collected from the monitor/production well (Well Registry No. 55-518877) at the Hermit Mine site.

1.1 Background

The evaluation is part of EFN's program of proposed actions to determine the causes of the unanticipated exceedances of water quality standards established for the site. The program was presented in the document entitled "Hermit Mine, Groundwater Monitoring Report, Mining Phase" dated February 12, 1990 (EFN, 1990) that was submitted to the Arizona Department of Environmental Quality in accordance with the Hermit Mine Groundwater Quality Protection Permit (Permit) requirements for reporting. As discussed in the report, exceedances of the Maximum Groundwater Limits (MGLs) were identified for water quality samples collected from the monitoring well during the Mining period (September 1989 through December 1989). Exceedances of the MGLs continued to occur into the Post-Mining period prior to the initiation of this program (February 1990 through August 1990).

Table 1.1 presents a summary of the MGLs and the water quality data reported for the Mining and Post-mining periods. The samples were analyzed for total concentrations, except for the constituents that are shown boxed on Table 1.1, which were analyzed for dissolved concentrations. Exceedances of the MGLs are indicated as shaded values. As shown, concentrations of uranium have consistently exceeded the MGLs in the water samples except for sample HER 066 collected and analyzed in June 1990. Additionally, 15 other parameters or constituents, including specific conductance, alkalinity, bicarbonate, chloride, phosphate, calcium, magnesium, potassium, sodium, barium, iron, manganese, gross beta, radium-226, and thorium-230,

were reported in concentrations exceeding the MGLs in one or more samples during this same time period.

Several potential causes of the exceedances were discussed in EFN's report (EFN, 1990) including:

1. Increased sediment in the water;

2. Errors due to sampling and/or analytical procedures and variability; and

3. Natural conditions or seasonal changes in water quality due to factors such as variable precipitation.

Mining activities, e.g., seepage from the mine, were not discussed as a potential cause of the exceedances because of the physical separation of the mine workings from the aquifer by more than 1,000 feet of impermeable material. A discussion of the effectiveness of the physical barrier was included in the EFN's February 1990 report (EFN, 1990).

Water well is not fully cased

Not proven stratigraphy is impermeable

Strata is permeable at other mines on northside of GCNP

EFN implemented this program to evaluate whether the increased sediment and/or the sampling/analytical procedures could be the cause of the exceedances. The evaluation consisted of the following four tasks:

1. Task 1 - Review of existing water quality data to identify trends or patterns, particularly an increasing trend in constituent concentrations indicating that mining caused a deterioration in water quality.

2. Task 2 - Review of sample collection and handling procedures to determine whether the procedures followed generally accepted practices and, if not, evaluate whether the exceedances could be the result of a failure to implement adequate collection or handling procedures.

3. Task 3 - Implementation of a laboratory Quality Assurance/Quality Control (QA/QC) program to identify potential laboratory analytical error and evaluate whether the exceedances could be related to any errors identified.

4. Task 4 - Review of water quality standards to evaluate the appropriateness of the standards contained in the Permit, particularly for the radionuclide constituents.

1.2 Summary of Results

The results of the water quality data evaluation indicated that the water quality at the Hermit Mine site has not deteriorated as a result of mining activities and that the exceedances of the MGLs for constituents measured in the water samples from the monitor/production well were the result of a combination of increased sediment load and improper sample collection procedures. This conclusion is based on the following factors:

1. The quality of the water in the mine, represented by the samples from the sump, is similar to the quality of the aquifer, represented by the samples from the well. The only exceptions are the radionuclides, nitrate, and arsenic which are present in the sump water in concentrations 10 to 10,000 times higher than the concentrations measured in the well water, and iron and manganese which are present in the sump water in concentrations 2 to 40 times lower than in the well water.

2. If seepage from the mine were the source of the exceedances in the well water, then the constituents that are present in the highest concentrations in the sump water as compared to the concentrations in the well water (radionuclides, nitrate, and arsenic) would be expected to exhibit increasing concentrations (and exceedances of the standards) in the well water after mining operations commenced. However, radionuclide concentrations, which exhibit the highest contrast in concentrations between the sump water and the well water, do not show a trend of increasing concentrations after

mining activities commenced. Rather, the exceedances that are reported are erratic as the reported concentrations fluctuate at levels below and above the MGLs. Also, the concentrations of nitrate and arsenic remained stable at levels below the MGLs throughout the Mining and Post-mining periods.

Fe & Mn could be due to oxidation of sulfide mineralization from groundwater flowing down pipe

3. As a contrasting argument, if seepage from the mine was the cause of the exceedances of the MGLs in the well water, then constituents such as iron and manganese, which are present in the sump water in concentrations several times lower than the concentrations in the well water, would not be expected to show a trend of increasing concentrations or exceedances of the MGLs after mining operations commenced. However, both iron and manganese are reported in concentrations exceeding the MGLs for 60 to 100 percent of the well water samples collected during the Mining and Post-mining periods.

4. A trend of increasing constituent concentrations was evident during the Pre-mining period, prior to commencement of mining operations. This trend continued into the first months of the Mining period, after which concentrations stabilized.

5. The increase in constituent concentrations and exceedances of MGLs reported during the Mining period coincide with an increase in the sediment in the water that began during the Pre-mining period.

6. The sediment load in the water, as indicated by the concentrations of total suspended solids (TSS), increased from very low levels [9 to 14 milligrams per liter (mg/l)] during the Pre-Mining period to higher levels (40 to 90 mg/l) during the Mining and Post-mining periods.

7. The volume of water purged prior to sample collection was three casing volumes for this evaluation as compared to only one casing volume for previous sample collection events.

8. The number of constituents reported in concentrations exceeding the standards was 1 for the three replicate samples collected for this evaluation, as compared to 2 to 7 constituents for previous sampling events. Also uranium did not exceed the MGLs in the three replicate samples analyzed for this evaluation in contrast to past analyses where uranium concentrations exceeded the MGLs in 9 out of 10 samples.

9. The analytical precision and accuracy quantified from the laboratory QA/QC program was acceptable for almost all the constituents analyzed.

Also, the evaluation indicates that water quality standards are inappropriately applied to certain constituents, in particular gross alpha and gross beta. According to the National Interim Primary Drinking Water regulations Part 141.15(a) and Part 141.15(b), gross alpha and gross beta activities are included in water quality analyses to screen for the presence of alpha- and beta-emitting radionuclides. Once the screening identifies the presence of the radionuclides, then the gross alpha and gross beta analyses can be eliminated and only the alpha- and beta-emitting radionuclides are monitored. Gross alpha reported by mine are questionable.
For example, 8/1998 sampling gross alpha (9 pCi/L) is lower than Ra226 (10.99 pCi/L)

Rather than determining the gross alpha and gross beta activities from the screening analytical procedure, they can be calculated from the measured concentrations of the radionuclides. Since the screening technique is not accurate, analysis of the radionuclide concentrations provides a more accurate estimate of the gross alpha and gross beta activities.

Furthermore, a standard is normally applied to gross beta only if man-made radionuclides such as strontium or tritium are present. Since no man-made radionuclides are present at the Hermit Mine site, the application of a gross beta standard is not appropriate.

1.3 Recommendations

Based on the results of the evaluation, several recommendations were developed to improve the quality and reliability of the water quality monitoring program for the Hermit Mine site. These recommendations include the following:

1. Purge a minimum of three casing volumes prior to sampling the well.

2. Monitor the indicator parameters, pH, specific conductivity, and temperature during the purging process. A difference of 10 percent or less between measurements taken at the beginning and end of the third casing volume purge will indicate that an adequate volume has been purged.

3. Order reanalysis of any constituents that are reported in concentrations exceeding the standards to minimize the exceedances that may be related to laboratory error.

4. Eliminate gross alpha and gross beta from the list of constituents monitored under the Permit.

2.0 WATER QUALITY DATA EVALUATION

The water quality data evaluation consisted of the following four tasks:

1. Task 1 - Review of existing water quality data;
2. Task 2 - Review of sample collection handling procedures;
3. Task 3 - Implementation of a laboratory QA/QC program; and
4. Task 4 - Review of water quality standards.

A description of these tasks is provided in the following sections.

2.1 Task 1 - Review of Existing Water Quality Data

A review of existing water quality data was conducted to determine whether any trends or other indications of water quality deterioration were evident. The review focused on determining whether trends could be identified that indicated that the exceedances of the standards were consistent and could be related to a cause such as an introduction of contaminated water from the mining activities.

For example, an increasing trend in the concentration of metals and radionuclides would be expected if mine water migrated into the aquifer. As stated in the Permit, the purpose of the Mining and Post-mining water quality monitoring is to determine:

1. What impacts, if any, the mining operation is having on the ground water quality (of the Redwall-Muav aquifer); and
2. The effectiveness of the closure activities (to prevent impacts on ground water quality after the mine is closed).

If the mining were to have an impact on water quality, the impact would be an increase in constituent concentrations, measured in the monitoring well.

Increases in constituent concentrations would be expected for certain metals and radionuclides which are present in higher concentrations in the mine water than in the aquifer. Therefore, a trend of increasing concentrations of metals and radionuclides after mining operations started would indicate that mine water was contaminating the aquifer. Similarly, if mine closure activities were not effective in preventing the migration of mine water to the aquifer, then constituent concentrations would be expected to increase or continue to increase after mining operations ceased.

The review showed that the quality of the water in the mine is similar to the quality of the water from the well. The only exceptions are nitrate, arsenic, and the radionuclides which are present in the mine water in concentrations exceeding the ambient quality of the aquifer (as represented by the MGLs) by one to four orders of magnitude. If mine water had impacted the quality of the aquifer, concentrations of these constituents would be expected to reflect an increasing trend in concentrations . However, these constituents did not exhibit increasing concentrations in the Mining and Post-mining periods. Rather, the concentrations either fluctuated at levels exceeding the MGLs (e.g. the radionuclides) or remained at concentrations below the MGLs (e.g. nitrate and arsenic).

The review also indicated that the exceedances are in part related to the increased sediment load in the water. The trend of increasing constituent concentrations evident during the Pre-mining period coincides with an increase in the amount of sediment in the water as indicated by increasing TSS concentrations and observations by EFN personnel.

The following sections provide a discussion of the database used and a description of the review process.

2.1.1 Database

The database used for the review consisted of the analyses of samples collected from the well prior to mining (Pre-Mining), during mining (Mining), and after mining ceased (Post-Mining) and from the mine sump

during Mining. Five quarterly samples were collected from the monitor well during the Pre-Mining period (April 1988 to May 1989). The Mining period samples, including four samples from the mine sump and four from the well, were collected between June 1989 and December 1989. Finally, a total of six well samples and one sump sample have been collected during the Post-Mining period since January 1990.

In accordance with the Permit, the analyses of the Pre-Mining samples from the well were used to characterize the ambient water quality and to establish MGLs for water samples from the mine site monitor well. The Pre-Mining samples were all analyzed for total rather than dissolved concentrations of constituents. As a result, the MGLs established for the site are for total concentrations. Therefore, for the evaluation of trends, only the Mining and Post-mining samples that were analyzed for total constituent concentrations were included.

Analytical results for dissolved concentrations were not included in this evaluation because the sample preparation for dissolved constituents is different from the procedure for total constituents and the analytical results are not comparable. Samples for analysis of dissolved constituents (metals) are filtered prior to preservation with acid. The filtration process removes sediment or suspended solids.

In contrast, samples prepared for analysis of total metals are not filtered prior to acidification. As a result, total metals concentrations may be higher than dissolved concentrations because metals adsorbed to or contained in the sediment/suspended solids can be added to the sample water by the acidification process. Therefore, inclusion of the dissolved metals analytical results would confuse the interpretation of the data, especially evaluation of changes in concentration over time (trends), since these results can represent different water quality conditions than those represented by the total concentration results.

Table 2.1 lists the data that were used in the evaluation. Note that dissolved concentrations of metals were analyzed for samples HER-061

through HER-069. Therefore, no metals concentrations are reported for these samples.

2.1.2 Data Review

The first step in the evaluation consisted of a comparison of the quality of the water from the aquifer (i.e. the well) and from the mine (i.e. the mine sump). The mine sump samples represent the quality of the water that would impact the aquifer quality if communication between the mine and the aquifer existed. Table 2.1 presents the analytical results for the water samples collected from the sump and the well during the mining period. Sampling of the sump was not required under the Permit after mining operations ceased.

Review of Table 2.1 shows that the quality of the water in the sump is similar to the water in the well with the exception of nitrate, several metals and the radionuclides. For example, sulfate concentrations measured in the well ranged from 1150 mg/l to 2310 mg/l with 90 percent of the values falling in the range of 2240 mg/l to 2300 mg/l. Sulfate concentrations in the sump water ranged from 2180 mg/l to 2300 mg/l with an average concentration of 2243 mg/l. The metals concentrations in the sump and well water were either the same or, in one or two of the samples, differed by no more than 50 percent.

In contrast, the concentrations of nitrate, arsenic, and radionuclides in the samples from the mine sump were 10 to 10,000 times higher than the concentrations in the well water. As shown in the table, concentrations of the radionuclides exhibited the greatest magnitude of difference in concentration (3 to 4 orders of magnitude) between the sump water and the well water. Nitrate concentrations in the sump water were in the range of 6.0 mg/l to 51.3 mg/l whereas the concentrations in the well water were below the detection limit of 0.1 mg/l. These concentrations are also 8 to 64 times higher than the background levels of the well water represented by the MGL of 0.8 mg/l. Finally, the arsenic concentrations in the sump water ranged from 0.205 mg/l to 1.09 mg/l which is 8 to 40 times higher than the background concentration of 0.204 mg/l.

If communication between the mine and the aquifer did exist, then evidence for the communication would be an increase in the concentrations of those constituents in the highest concentrations in the sump water as compared to the same constituents in the well water. As discussed above, these constituents are the radionuclides, nitrate, and arsenic.

However, as shown in Table 2.1, nitrate concentrations in water samples from the well remained below both the MGL and the detection limit and arsenic concentrations remained 3 to 6 times below the MGL throughout the Mining and Post-mining periods. Of the radionuclides, only uranium was reported in concentrations that consistently exceeded the MGL throughout the Mining and Post-mining periods. The remaining radionuclides either did not exceed the MGLs (gross alpha) or exhibited erratic exceedances (gross beta, radium-226, and thorium-230). The fact that the well water does not exhibit an increase in the concentrations of the constituents of highest contrast in concentration indicates that a source other than mining activities is the cause of the exceedances in the well water.

A contrasting argument also provides support for the conclusion that a source other than communication between the mine and the aquifer is the cause of the exceedances in the well water. Review of Table 2.1 shows that two additional constituents, iron and manganese, are also present in substantially different concentrations in the sump water as compared to the well water. However, in contrast to the previous discussion, the concentrations of these two constituents in the sump water are less than in the well water. Iron concentrations in the sump samples ranged from 0.11 mg/l to 0.29 mg/l, which is 10 to 100 times lower than the concentrations in the well water. Similarly, manganese concentrations ranged from 0.04 mg/l to 0.08 mg/l, which is 2 to 5 times lower than the concentrations in the well water.

Since the concentrations of these two constituents are much lower in the sump water than in the well water, an increase in their concentrations in the well water could not be caused by seepage of water from the mine. Therefore, an increase in concentration of these two constituents in the well water during the Mining and Post-mining periods would indicate that a

mechanism other than mine seepage was causing the increase. Review of Table 2.1 shows that the concentrations of iron and manganese exceeded the MGLs in 60 percent and 100 percent, respectively, of the well water samples collected during the Mining and Post-mining periods. These exceedances indicate that the quality of the aquifer changed as a result of causes unrelated to the mining activities.

One of the potential causes of the exceedances in the well water is the increased sediment in the well. A discussion of the increased sediment was first addressed in EFN's mining phase report (EFN, 1990) that identified the exceedances of the MGLs and presented the proposed program for evaluating the exceedances. According to EFN personnel, the increased sediment became noticeable in January and February 1989 because of a color change from clear to red and deposition of sediment in the components of the pump that are located at the ground surface. Color change to red could be a result of dissolved Fe precipitating back out of solution

Review of Table 2.2 confirms the observations made by EFN personnel that the sediment load increased during the Pre-mining period. Concentrations of TSS for the three samples collected prior to January/February 1989 ranged from 9 mg/l to 18 mg/l. The concentrations of TSS increased 5 to 10 times (to 88 mg/l) in the sample collected in May 1989. Concentrations of TSS remained high into and through the Post-mining period. Analyses of TSS were not conducted during the Mining period. However, concentrations reported for the Post-mining period ranged from 42 mg/l to 93 mg/l with an average of 61 mg/l.

Assuming that the the sediment was the cause of the exceedances of the MGLs, increases in constituent concentrations would be expected to coincide with increased concentrations of TSS. To determine whether such a relation exists, concentrations of TSS, uranium, iron, and manganese were plotted on a graph. Figure 2-1 illustrates the resulting graphs.

The figure clearly illustrates that the increased concentrations of TSS coincide with increases in the concentrations and with the exceedances of the MGLs noted for the three metals. Note that all three metals show a trend of increasing concentrations during the Pre-mining period, when TSS

concentrations also increased. TSS concentrations remained elevated into the Post-mining period and the concentrations of the three metals also remained higher during this time as compared to the Pre-mining period.

The figure also shows that the concentrations of dissolved uranium were an order of magnitude less than the concentrations of total uranium. If no sediment or suspended solids are present in the water, these two concentrations are very similar. However, as discussed in the beginning of this section, total concentrations can be higher than dissolved concentrations if sediment in the water contributes additional metals (uranium is considered to behave as a metal chemically) during the acidizing process. Therefore, the contrast between the total and dissolved uranium concentrations provide further evidence of the presence of the sediment in the water.

In summary, the review of the existing data clearly indicates that sediment in the well water is one of the causes of the exceedances of the MGLs and that the exceedances are not related to mining activities. Other potential causes of the exceedances will be evaluated in the following sections.

2.2 Review of Field Sampling Procedures

A review of the field sample collection procedures was conducted to determine whether the procedures follow generally accepted practices. Sampling procedures were also evaluated to determine whether they could be a cause of the exceedances.

The field sample collection procedures used by EFN follow the provisions of the Permit. Overall, the sample collection and handling procedures used should minimize any error. However, in accordance with the Permit monitoring requirements, only one casing volume is being purged prior to sample collection. One casing volume may not be sufficient to remove all the stagnant water in the well and, as a result, the collected water samples may not have been of consistent quality or representative of the formation water. Removal of the stagnant water is especially a concern in light of

the results of the previous task which indicated that sediment in the water may have caused the exceedances.

Thorough flushing (purging) is necessary to obtain representative ground water samples. A thorough purge is an effort to fill the well with fresh formation water. According to Wilson and Rouse (1983), the quality of standing or stagnant well water may differ from formation water; therefore, purging is necessary to ensure that the sample is fresh water representative of aquifer conditions.

The well is not fully cased, what volume of water is considered a casing volume?

The number of casing volumes that need to be purged varies depending on the well construction and the transmissivity of the aquifer (the rate at which water can be transmitted through a unit thickness of the aquifer), but the minimum number recommended is three casing volumes. The Environmental Protection Agency (EPA), in the document entitled "RCRA Ground-Water Monitoring Technical Enforcement Document" (EPA, 1986), recommends that three casing volumes be purged. Removal of at least four well casing volumes is recommended by a number of authors studying monitor well purge phenomena (Gibb, 1984; Shuller, et al., 1981; Keith, et al., 1983; Giddings, 1983; Urwin and Huis, 1983; Wilson and Rouse, 1983; Schmidt, 1982; Seanor, 1984; Seanor and Brannaka, 1983; Scalf, et al., 1981; United States Geological Survey, 1980).

The above-listed authors also generally recommend monitoring of the indicator parameters (temperature, pH, and specific conductivity) during the purging process to determine when the water quality has stabilized. The EPA (1986) also requires that these parameters be monitored as part of the purging process. Stabilization of the parameters provides an indication that the stagnant water has been removed and that clean formation water is being pumped. However, past sampling procedures have not included monitoring for the indicator parameters. As a result, verification that the water quality is stable and representative of the formation water has not been possible.

Table 2.3 presents a comparison between new data obtained from three ground water replicate samples collected for this evaluation and previous ground

water quality data. The samples for this program were collected after purging approximately three casing volumes rather than one volume as in previous sample collection events. The comparison was made by comparing the number of constituents that exceeded the MGLs for each sample.

The results of the comparison indicate that the erratic exceedances of the MGLs in the Mining and Post-mining water quality data were due to insufficient purge volume. As shown in Table 2.3, only one constituent, gross beta, was reported in concentrations exceeding the MGLs for the three replicate samples collected during this evaluation. In contrast, the table shows that in the past a total of 15 different constituents have been reported in concentrations exceeding the MGLs. The most notable improvement was exhibited by uranium which did not exceed the MGLs in the samples collected for this evaluation whereas previously concentrations of uranium exceeded the standards in 9 out of 10 samples.

Review of Table 2.1 shows that samples collected in the past had 2 to 7 constituents reported in concentrations exceeding the MGLs as compared to only one constituent in this set of samples. The fact that only one exceedance is evident for samples collected during this evaluation, and 2 to 7 times that number of exceedances were evident during previous sample collection events, indicates that the insufficient purging procedures effected the analytical results. Also, the exceedances that were evident in the previous samples were present as erratic fluctuations from low concentrations to high, indicating that the water quality was changing over the short time periods of one to three months between sampling events. Erratic fluctuations in water quality do not normally occur if a contaminant source, such as the mine, is the cause of the change in water quality. Consequently, one casing volume appears not to be sufficient to remove all the stagnant water in the well.

Erratic flucuations do not generally occur naturally.

Most mines are lateral flow not vertical flow.

This statement is is questionable.

Support for this conclusion is provided by preliminary data from samples collected after sample collection for this evaluation in October 1990. The graph of uranium concentrations presented on Figure 2-1 includes data for samples collected in November and December, 1990, and January, 1991. The samples were collected after a minimum of three casing volumes was purged

from the well. As shown, the concentrations of uranium for all three samples were below the MGL and were even lower than the concentrations reported during the Pre-mining period.

Also, the concentration of TSS in the three replicate samples was 4 mg/l, as compared to an average of 61 mg/l for the five Post-mining water quality samples collected prior to this evaluation. The additional purge volumes helped to remove the sediment that was in the stagnant water in the well.

Future sample collection events using the higher purge volume of at least three casing volumes and monitoring of the indicator parameters during purging will verify this conclusion.

2.3 Task 3 - Laboratory QA/QC Evaluation

The evaluation of laboratory analytical performance was conducted to satisfy the following:

1. To assess the analytical accuracy of the analytical laboratory;

2. To determine the analytical laboratory's internal level of precision;

3. To assess the variability of sample results that may result from sample transport and/or sample handling in the laboratory; and

4. To compare the analytical laboratory's accuracy performance with an independent laboratory.

Samples were submitted to Barringer Laboratories, Inc. (Barringer), the laboratory that typically conducts the analyses of the Hermit Mine water quality samples. The independent laboratory used in the evaluation was AccuLabs Research, Inc. (AccuLabs).

2.3.1 Program Design

The laboratory QA/QC evaluation was designed to evaluate the performance of the laboratory in analyzing the constituents that are required in the Permit. Table 2.4 lists the analytes that were included in the evaluation. This evaluation was based on the analysis of the following five types of QA/QC samples:

1. Spike samples;
2. Spike sample replicates;
3. Ground water sample replicates;
4. Trip blank samples; and
5. Field blank samples.

All the QA/QC samples were shipped to Barringer and AccuLabs from the field and were "blind," or indistinguishable from ordinary ground water samples in labeling and packaging, so the laboratories could not identify them as QA/QC samples.

An explanation of the purpose of each of the sample types is provided below:

Spike Samples - A spike sample is a laboratory-prepared solution of deionized water containing known concentrations of analytes. Analyses of spike samples are used to assess the accuracy of the laboratory, i.e., the ability of a laboratory to determine the correct concentration of each analyte.

A spike sample was prepared from a single parent solution by Energy Laboratories in Casper, Wyoming. As shown in Table 2.4, the sample contained known concentrations of ions (sodium, potassium, chloride, and sulfate), total dissolved solids (TDS), metals (chromium, iron, manganese, and zinc),

and uranium. The spike sample also contained a known level of gross alpha due to uranium activity.

For the purpose of this program, an additional spike sample was split from the parent spike sample and sent to AccuLabs to compare the accuracy results of Barringer to an independent laboratory.

Spike Replicate Samples and Ground Water Replicate Samples - Replicate samples are used to assess laboratory precision. Replicate samples consist of a group of samples that contain the same water chemistry. Ideally, the laboratory should produce the same results for each replicate. Analysis of the spike replicate samples provides information on the laboratory's precision and may also be used to relate the laboratory's precision to accuracy.

For the purpose of this program, three replicate samples were prepared from the spike solution and three from the ground water sample. Each spike and ground water replicate sample was then sent to Barringer from the field.

Table 2.4 lists the analytes for the spike replicate and ground water replicate samples. Precision analyses were performed for all analytes showing detectable concentrations in the replicate samples.

Field Blank Samples - A field blank consists of deionized water that is placed into a sample container in the field. Ideally, if samples are collected correctly and sample containers are not contaminated, the analyses of field blanks should yield nondetectable concentrations for all metals and radionuclides. The use of field blanks provides a measure of variability that may be occurring as a result of sample handling in the field. For this program, one field blank labeled in a "blind" manner was sent to Barringer. Table 2.4 lists the analytes for the field blank sample.

Trip Blank Samples - A trip blank contains deionized water sealed in a sample container at the preparing laboratory. Trip blanks were prepared and then shipped "blind" to Barringer. Ideally, analyses of trip blanks should give nondetectable concentrations for all metals and radionuclides.

These blanks determine whether any contamination or other accuracy problems occur as a result of the sample handling and/or analytical procedures of the analytical laboratory. Table 2.4 lists the analytes for trip blanks.

2.3.2 Evaluation of Results

The results of this evaluation are presented in terms of the laboratory accuracy in analyzing the spike samples, precision in analyzing the replicate samples, and the number of constituents reported in detectable concentrations for the blank samples. Based on EPA guidelines (EPA, 1989), the laboratory performance in terms of accuracy and precision was acceptable for all constituents with the exception of zinc and gross alpha. The number of detectable constituents in the blank samples was low.

The fact that the laboratory had acceptable performance for most of the constituents, several of which were reported in concentrations in the well water exceeding the MGLs, indicates that error due to laboratory analytical procedures is not a cause of the exceedances in the well water. Although the laboratory performance for analyzing zinc and gross alpha was unacceptable, neither of these constituents was reported in concentrations exceeding the MGLs in samples collected from the well during the Mining or Postmining periods.

Laboratory Accuracy

Laboratory accuracy was determined based on the analytical results of the spike samples. Table 2.5 lists concentrations of the 11 selected chemical constituents in the spike sample. These are the values that are known to exist in the spike sample prior to laboratory analysis. Table 2.5 also provides the chemical concentrations or values that were reported by Barringer for each replicate of the spike sample. Since each spike replicate sample was drawn from a single parent solution, the analytical results for all the replicates should be identical to the known spike sample concentrations.

Accuracy is represented by the magnitude of the difference between the concentration in the spike sample and the concentration reported by the laboratory. The smaller the difference between the two values, the greater the accuracy. For example, review of Table 2.5 shows that for chromium, the spike sample value and the three spike replicate values were the same. Therefore, the accuracy of Barringer for analyzing chromium was high. In contrast, the large difference between the spike sample values and the three reported values existing for gross alpha indicates that Barringer has low accuracy in analyzing this radionuclide.

In order to quantify the accuracy of Barringer for each analyte, the values reported were normalized. Normalized values are reported as a percentage and represent the relative percent difference (RPD) between the reported laboratory value and the spike value.

The normalizing procedure utilized the following formula:

$$RPD = \left| \frac{VR}{VS} - 1 \right| \times 100$$

Where: VR is the laboratory-reported value of constituent X; and
VS is the known or spike value of constituent X.

The purpose of normalizing the values is to prevent the assessment of accuracy from being skewed by differences in the actual spike values for different constituents. The rationale for this procedure is evident if one considers an example where the spike value is 1.0 mg/l and the reported value is 0.9 mg/l. Using the above formula, this yields an RPD of 10 percent. Using the same procedure, a sample RPD of 10 percent would also be calculated for the situation where the spike value is 100 mg/l and the reported value is 90 mg/l.

For water quality samples, the EPA in their "Statement of Work" for the Contract Laboratory Program (EPA, 1989) recognizes that an RPD of less than 20 percent is the acceptable accuracy for laboratory analyses. Ideally, the RPD should be zero but, because of variability inherent in the analytical process, this ideal accuracy is not practically achievable.

Results of Evaluation

RPD values computed from the analyses of the spike samples are displayed in Table 2.5 and illustrated on Figures 2-2 through 2-4. The RPD values were then further classified as being representative of acceptable or unacceptable accuracy based on the 20 percent RPD criteria.

Figure 2-2 shows RPD values for each major ion constituent. Barringer demonstrated adequate accuracy for sodium, potassium, chloride, sulfate, and TDS in all cases.

Figure 2-3 shows RPD values for each metal spike constituent. Barringer demonstrated consistently adequate accuracy for chromium, iron, and manganese in all cases. However, Barringer did not meet the EPA accuracy criteria for zinc in three out of three samples or 100 percent of the time.

The cause for the poor accuracy performance for zinc is believed to be contamination in the laboratory during analysis. Zinc is ubiquitous in the environment and could have been incorporated in the samples when the sample containers were opened for the analyses. Also, zinc is not a concern from a water quality standpoint because it has never been reported in concentrations exceeding the MGLs.

Figure 2-4 shows RPD values for uranium and gross alpha. Barringer demonstrated consistently adequate accuracy for uranium. However, Barringer did not meet the EPA accuracy criteria for gross alpha in the spike samples in three out of three times or 100 percent of the time. As with zinc, the poor accuracy for gross alpha is not a concern from a water quality standpoint since it has never been reported at activity levels exceeding the MGLs.

Verification of Spike Sample and Analytical Accuracy

In order to verify that the spike sample contained the concentrations as indicated by the laboratory preparing the spike (Energy Laboratories) and to provide an independent check of analytical accuracy, one spike replicate

sample was shipped blind to AccuLabs for analysis. Table 2.6 presents the analytical results from both laboratories for the same spike sample. The results from Barringer presented in the table are mean values for the three spike replicate samples.

As shown in Table 2.6 both analytical laboratories demonstrated acceptable accuracy for major ions and metals. The only exceptions were that, as discussed previously, Barringer showed unacceptable accuracy for zinc where as AccuLabs showed unacceptable accuracy for sulfate. These results confirm that the spike sample contained the appropriate concentrations of constituents as reported by the preparing laboratory.

The accuracy results for uranium and gross alpha confirmed the previous results that Barringer had unacceptable accuracy for analyzing gross alpha. The spike sample contained a known amount of natural uranium (0.04 mg/l). Both laboratories had acceptable accuracy detecting all the uranium concentration in the sample. This spike sample did not include any other radionuclide; therefore, uranium was the only alpha-emitting radionuclide. The known amount of uranium (0.04 mg/l) in this sample generates 27.08 picoCuries per liter (pCi/l) gross alpha activity.

Results of the analyses showed that Barringer did detect uranium but the reported gross alpha activity was consistently low resulting in unacceptable accuracy. On the other hand, AccuLabs detected the correct level of gross alpha activity (approximately 25 pCi/l). This suggests that Barringer had an analytical error for the gross alpha analyses.

Laboratory Precision

Precision describes the ability of a laboratory to successively repeat an analysis of a given sample and produce identical results. Precision was determined for Barringer through the use of spike sample replicates and ground water sample replicates. Ideally, a laboratory with perfect precision would produce identical results for all replicates.

Quantification of the statistical spread of replicate values for each constituent is necessary to quantify the precision of laboratory performance. The statistical measure of data spread is the normalized standard deviation, which is known as the coefficient of variation (CV). The CV is calculated as the standard deviation divided by the mean (average value) and multiplied by 100 (i.e., the standard deviation as a percentage of the mean). This normalizing procedure allows comparison of data spread regardless of the magnitude of the reported values.

Although no absolute standard for precision exists in the literature, the comparison of CV values between analytes indicates relative levels of precision. The smaller the CV value, the higher the level of precision relative to other analytes.

Results of Evaluation

CV values were calculated for both spike sample replicates and ground water sample replicates. Table 2.7 presents the analytical results and calculated CV values for the spike sample replicates and ground water sample replicates.

The statistical evaluation of precision depends on the existence of measurable quantities of analytes. If an analyte is nondetect in all cases of analyses, then the statistical evaluation of precision cannot be made.

Calculated CV values shown in Table 2.7 indicate that Barringer demonstrated adequate precision for most major ions and metals. For example, the calculated CV values for both the spike replicate and ground water replicate samples were close to or less than 1.0. The higher CV value for zinc reported for the spike replicate samples and the values for silica, calcium, mercury, sulfate, iron, and zinc for the ground water replicate samples indicate lower precision as compared to the low CV values reported for the remaining major ion and metal constituents.

The CV values for the radionuclides are consistently higher than the values for the major ion and metals constituents. This lower level of precision

is normal for radionuclide analysis and is reflected as the counting error at the 95 percent confidence level. For example, the counting error for gross alpha was 4 and 5 for the spike replicates and 24 and 26 for the ground water replicates.

The spike sample replicates provide information that may also be used to relate the laboratory's precision to accuracy. A laboratory can provide acceptable precision for a given constituent while producing inaccurate results. In this case, the acceptable precision that is derived from inaccurate results is misleading. For example, Table 2.7 shows that Barringer achieved an acceptable precision for zinc for spike replicate samples, as indicated by a low CV value (4.81). However, accuracy for the analyses of these samples was unacceptable with RPDs greater than 20 percent. Therefore, although Barringer had acceptable precision for analysis of zinc, the actual concentrations are not correct.

Field and Trip Blank Samples

The results of the analyses of the field and trip blanks were used to determine whether field sample handling, sample transport, laboratory sample handling, or analytical methods affected the accuracy of the analytical results. Table 2.8 lists the results of the analyses for the field and trip blanks. Nondetect and zero values are shaded.

As shown in Table 2.8, most of the constituent concentrations for both the field and trip blanks were close to or below the detection limit. Ideally, the analyses of these blank samples should yield nondetectable concentrations for these analytes. However, several analytes such as specific conductivity, alkalinity, TDS, and sulfate were reported in much higher concentrations in the trip blank than in the field blank. This discrepancy suggests that the deionized water used for the trip blank was not as pure as that used for the field blank.

The presence and similarity of detectable concentrations of zinc in both the field and trip blanks are of interest because they may indicate a potential source of contamination for this constituent. This contamination

may be the cause of the unacceptable accuracy performance for the zinc analysis discussed previously. The source of the contamination is believed to be the environment, but future analyses should include an extra margin of care in sample handling and preparation and analytical procedures.

2.3.3 Summary of Results

Method used for U concentration by Barringer did not have the lowest detection limit, or precision, in which the lab reported

In summary, the results of the laboratory QA/QC evaluation indicate that, except for zinc and gross alpha, the laboratory has acceptable accuracy and precision for analysis of constituents monitored for the Permit. If the laboratory had performed poorly in analyzing the constituents such as uranium or iron that were reported in concentrations exceeding the MGLs, then the laboratory accuracy and precision could be considered as another cause of the exceedances. However, since the laboratory accuracy and precision was unacceptable only for constituents that were not reported in concentrations exceeding the MGLs, laboratory performance is not considered to be a cause of the exceedances in the well water samples.

2.4 Task 4 - Review of Standards

The MGLs for the Hermit Mine site were reviewed to evaluate their appropriateness to ground water conditions at the site. Of particular concern were the standards applied to the radionuclides, since they are present in the highest concentrations in the spike water. Four main concerns related to the radionuclide standards are:

1. Application of standards to gross alpha and gross beta activity, which are used to screen for the presence of alpha- and beta-emitting radionuclides;

2. Establishment of radionuclide standards based on the reported values without consideration of the counting error;

3. Comparison of reported radionuclide values to the standards without consideration of the counting error; and

4. Application of a standard for gross beta when no man-made radionuclides are present on-site.

These concerns are addressed in the following sections.

2.4.1 Gross Alpha/Gross Beta Screening

Analysis for gross alpha and gross beta activity is used as a screening process to indicate the presence or absence of alpha- and/or beta-emitting radionuclides in water samples. As stated in the analytical procedures [American Public Health Association (APHA), 1976], "The method is a screening technique for monitoring drinking water supplies for alpha and beta particle activities according to the limits set forth under the Safe Drinking Water Act, PL 93-523, 40 FR 34324, and thereby determining the necessity for further analysis" (emphasis added). The necessity for further analysis of the alpha and beta-emitting radionuclides such as radium and strontium is based on the levels of alpha and beta activities determined from the screening. For example, Section 141.26(a)(ii) of the National Interim Primary Drinking Water Regulations requires analysis of radium-226 if the gross alpha activity measured by the screening exceeded 5 pCi/l.

Since more than eight alpha-emitting radionuclides and eight beta-emitting radionuclides (both natural and man-made) exist, the screening allows the identification of pertinent radionuclides without analyzing for each one individually. After the alpha- and beta-emitting radionuclides have been identified, monitoring for gross alpha and gross beta activities is no longer necessary because they can be calculated from the analyses of the individual radionuclides.

Calculation of the gross alpha and gross beta activities from the radionuclide concentrations provides a more accurate estimate of the activity levels than the screening. The screening analysis is not designed to be accurate, rather it is used to provide an indication of the types of radionuclides present in a sample of water. Also, as stated in the analytical procedure description (APHA, 1976), the accuracy of the procedure is

limited by the concentration of TDS in the water sample especially when the concentrations of the radioactivity in the sample are low as is the case for the well water at the Hermit Mine site.

For the Hermit Mine site, gross alpha and gross beta activities are currently being monitored in accordance with the Permit requirements. However, monitoring of only the radionuclides is recommended. Gross alpha and gross beta activities can be calculated from the radionuclide analytical results and, therefore, will be monitored by monitoring the radionuclides. Since the activity levels are determined by the concentration of radionuclides in the water, monitoring and establishing standards for the cause (radionuclide concentrations) rather than the effect (gross alpha and gross beta activities) provides a more accurate assessment of the quality of water.

2.4.2 Radionuclide Standards

Currently, the MGLs established for radionuclides under the Permit are based on the reported values without considering the counting error. The counting error indicates the range of the value reported at the 95 percent confidence level. For example, if the gross alpha activity for a water sample is reported to be 44 pCi/l with a counting error of $\pm$ 18 pCi/l, the actual value of the activity ranges from 26 pCi/l to 62 pCi/l. Due to the error inherent in radionuclide analysis, the activity cannot be reported as a single value but rather as a range of values.

Revision to the MGLs for the radionuclides is recommended to account for the counting error. Rather than assigning a single value to the MGLs, the MGLs could be reported as a range that includes the mean of the counting error plus two standard deviations. For example, the current MGL for gross alpha is 83.9 pCi/l. This value is calculated from the mean of the Pre-Mining reported values (20.4 pCi/l) plus two standard deviations (63.52 pCi/l). The mean of the counting error for these samples (19.6 pCi/l) plus two standard deviations (6.7 pCi/l) results in a counting error of $\pm$ 26.3 pCi/l. The revised gross alpha MGL would then range from 57.6 pCi/l (83.9 pCi/l minus 26.3 pCi/l) to 110.2 pCi/l (83.9 pCi/l plus 26.3 pCi/l).

Using the above procedure, the recommended radionuclide MGLs are listed as follows:

Analyte	MGL
Gross alpha	57.6 - 110.2 pCi/l
Thorium-230	0.2 - 1.8 pCi/l
Radium-226	3.5 - 5.2 pCi/l

2.4.3 Comparison to Standards

Currently, reported radionuclide values from each sample collection event are compared to the MGLs to determine whether they exceed the standard. However, this procedure does not account for the analytical error. Therefore, a different procedure for comparing reported values to the MGLs is recommended.

In the National Interim Primary Drinking Water regulations, Sections 141.26(a)(1) and 141.26(b)(4)(i), the EPA states that compliance with the standards shall be based on "...the average of the analyses of four samples obtained at quarterly intervals." By averaging the reported values analyzed over a one-year period, the inherent variability of the analytical results is accounted for.

Therefore, rather than comparing the reported values from each sample collection event to determine whether the site is in compliance, the mean of the reported values from at least four quarterly analyses should be compared to the MGLs. For example, the mean of the reported gross alpha values during the Mining period (four quarterly samples) was 36.8 pCi/l. In accordance with the federal regulations, this mean value rather than the values from the individual sample collection events would be compared to the MGLs to determine compliance.

Another approach would be to add the counting error to the reported values for each sample collection event and compare the resulting range of values to the recommended MGLs listed in Section 2.4.2. For example, the gross

alpha activity reported for the June 1989 sample collection event was 28 ± 21 pCi/l or ranged from 7 pCi/l to 49 pCi/l. This range would then be compared to the recommended MGL of 57.6 pCi/l to 110.3 pCi/l to determine compliance.

2.4.4 Gross Beta Standard

A standard for gross beta is normally not applied unless man-made radionuclides are present that can be identified as the source of the gross beta activity. For example, in the National Interim Drinking Water regulations, the maximum contaminant levels (Section 141.16) and monitoring frequency (Section 141.26) are established for "...beta particle...activity from man-made radionuclides in drinking water..." (emphasis added). Since no man-made radionuclides are present at the Hermit Mine site, establishing a gross beta activity is not appropriate.

3.0 CLOSING REMARKS

This report presents the water quality data evaluation that was conducted to identify potential causes of exceedances of the MGLs for water samples collected from the Hermit Mine site monitoring well. The focus of the evaluation was to identify factors such as sample collection procedures or analytical error that could cause the exceedances. In addition, the MGLs were evaluated to determine their appropriateness for the radionuclide analytes.

3.1 Conclusions

The major findings of this report are as follows:

1. Evaluation of the existing water quality data showed that the quality of the water in the mine was similar to that in the well. The only exceptions were the radionuclides, nitrate, and arsenic which were present in much higher concentrations in the mine than in the well, and iron and manganese which were reported in lower concentrations in the mine than in the well.

2. The existing water quality data provides evidence that the exceedances in the well were not caused by seepage from the mine. This conclusion is based on two contrasting arguments as follows:

   - If communication between the mine and the aquifer existed, then the constituents present in the mine water in highest concentrations as compared to the well water would be expected to cause increased concentrations and exceedances of these same constituents in the well water after mining operations commenced. However, the constituents in the highest concentrations in the mine water, the radionuclides, nitrate, and arsenic, exhibited only erratic exceedances of the MGLs (the radionuclides) were present in concentrations below the detection limit (nitrate), or were present in concentrations

below the MGLs (arsenic) throughout the Mining and Post-mining periods.

Also, concentrations of uranium did exhibit a trend of increasing concentrations, but this trend began during the Pre-mining period prior to commencement of mining operations. If mine seepage was the cause of the increased concentrations of uranium, the trend of increasing concentrations could not begin until after mining operations commenced. Therefore, a source other than seepage from the mine must be causing the exceedances in the well water.

- o A contrasting argument is presented for two constituents, iron and manganese, which were reported in lower concentrations in the mine water than in the sump water. In this case, assuming that communication exists between the mine and the aquifer, the concentrations of iron and manganese in the well would not be expected to increase or be present in concentrations exceeding the MGLs because concentrations in seepage from the mine would be too low to cause such a change. However, after mining operations commenced, concentrations of iron and manganese exceeded the MGLs in 60 to 100 percent of the samples. Therefore, since the mine water could not contribute sufficient concentrations of iron and manganese to cause these exceedances, a source other than mine seepage must be the cause of the exceedances in the well water.

3. The existing water quality data provide evidence that sediment in the well water is one of the causes of the exceedances of the MGLs. The sediment load in the samples of well water increased during the Pre-mining period and remained at the higher levels through the Mining and into the Post-mining periods. Increases in concentrations of constituents such as uranium, iron, and manganese coincided with the increased sediment in the water and also remained at the higher levels into the Mining and Post-mining.

Also, the concentrations of dissolved and total uranium differed by as much as an order of magnitude. These concentrations would be similar if low levels of sediment or suspended solids were in the well water.

4. Insufficient purge volume prior to sample collection is another cause of the inconsistent exceedances in the existing water quality. Improvement in the water quality was evident for samples collected during this evaluation when three casing volumes were purged prior to sample collection. Previously, only one casing volume was purged from the well prior to sample collection, and this volume was apparently insufficient to remove all the stagnant water in the well. Monitoring wells are purged to remove stagnant water. But this was a water well the mine used. The well should not have had an issue with stagnant water unless the samples were collected from boreholes such as the pre-mining samples were collected from

5. Analytical accuracy and precision is not an important factor causing the exceedances in water quality. Performance of the analytical laboratory was acceptable for all constituents except zinc and gross alpha. These constituents were not reported in concentrations exceeding the MGLs in the past, and the laboratory exhibited acceptable accuracy and precision for the remaining analytes including those reported in concentration exceeding the MGLs in the well water.

6. Water quality standards (MGLs) are inappropriately applied to the radionuclides for the following reasons:

   - First, the analytical procedure for gross alpha and gross beta activity is a screening technique to identify the presence of alpha- and beta-emitting radionuclides in the water. Continued monitoring of the gross alpha and gross beta activities is unnecessary because the radionuclides, from which they originate, are already being monitored. Since the activity levels are a function of the concentrations of the radionuclides in the water, monitoring and establishing standards for the cause (radionuclide concentrations) rather than the effect (gross alpha and gross beta

activities) provides a more accurate assessment of the quality of the water.

- o Also, a standard is in appropriately applied to gross beta since no man-made radionuclides were used on-site.

- o Finally, the current MGLs do not take into account the counting error, and comparison of the data collected to the MGL does not include the counting error. Revisions to the MGLs should include counting error.

3.2 Recommendations

The following recommendations have been developed to improve the reliability of the water quality data generated for the monitoring program required by the Permit.

1. Purge a minimum of three casing volumes prior to sampling the well.

2. Monitor the indicator parameters, pH, specific conductivity, and temperature during the purging process. A difference of 10 percent or less between measurements taken at the beginning and end of the third casing volume purge will indicate that an adequate volume has been purged.

3. Order reanalysis of any constituents that are reported in concentrations exceeding the standards to minimize the exceedances that may be related to laboratory error.

4. Institute a field and laboratory QA/QC evaluation on an annual basis to minimize and identify potential problems with the sampling or analytical procedures.

5. Eliminate gross alpha and gross beta from the list of constituents monitored under the Permit.

Respectfully submitted,

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Senior Technical Manager

RSP/vv

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REFERENCES

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TABLES

TABLE 1.1

SUMMARY OF WATER QUALITY DATA
HERMIT MINE SITE MONITORING WELL

Analyte	Maximum Groundwater Limit	Mining				Post-Mining					
		HER 044 6/29/89	HER 048 9/21/89	HER 051 10/19/89	HER 052 12/07/89	HER 061 3/29/90	HER 64 4/27/90	HER 065 5/31/90	HER 066 6/30/90	HER 069 7/31/90	HER 070 8/31/90
pH (pH unit)	6.85	NT	6.92	NT	7.29	6.98	8.06	7.15	7.10	7.28	6.69
Spec. Cond. (umhos/cm)	3555	NT	3470	3600	3470	3330	3318	3234	3400	3261	3360
Alkalinity	161	NT	150	NT	155	149	170	162	154	152	165
Carbonate	0	NT	NT	<1.0	<0.5	<1.0	<1.0	<1.0	<1.0	<0.1	0.0
Bicarbonate	161	NT	150	150	155	149	170	162	154	152	165
Chloride	44	NT	40	39	52	38	41	38	43	39	40
TDS	3615	NT	3440	3220	3310	3430	3320	3380	3440	3540	3390
TSS	107	NT	NT	NT	NT	59	93	42	44	67	NT
Nitrate as N	0.8	0.30	<0.1	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate as P	0	NT	<0.1	<0.01	<0.01	0.2	0.3	<0.1	<0.1	0.2	0.3
Sulfate	2425	NT	2280	2280	2280	2290	1150	2240	2310	2250	2300
Silica	14.3	NT	11.5	9.8	8.9	13.6	13.3	12.9	10.4	14.3	NT
Calcium	630	NT	542	547	466	609	610	578	592	632	549
Magnesium	199	NT	186	201	155	186	186	188	193	211	178
Potassium	28.7	NT	24.2	31.6	44.5	24.2	22.5	21.7	23.5	22.7	20.7
Sodium	85.7	NT	76.0	102.0	NT	72.6	82.6	76.3	81.9	82.6	70.7
Flouride	1.53	NT	1.28	1.43	1.30	1.40	1.4	1.20	1.20	NT	1.40
Arsenic	0.024	0.004	0.008	0.022	0.008	0.003	<0.001	0.003	<0.01	0.001	<0.001
Barium	0.06	0.020	0.02	0.01	0.02	0.03	0.01	0.01	0.02	<0.01	0.17
Cadmium	0.027	0.006	<0.005	<0.005	<0.005	0.009	0.007	<0.005	0.009	<0.005	<0.005
Chromium	0.21	NT	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.04	0.02	<0.01	<0.01	0.02	0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	11.21	12.0	11.6	4.71	1.13	13.5	13.2	11.7	0.97	12.7	12.4
Lead	0.16	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese	0.19	0.23	0.49	0.39	0.25	0.22	0.18	0.17	0.53	0.17	0.19
Mercury	0.002	<0.0002	<0.0002	<0.0002	0.0002	0.0003	<0.0002	<0.002	<0.0002	<0.0002	<0.0002
Silver	0.03	<0.01	<0.01	<0.01	NT	0.01	<0.01	<0.01	0.01	<0.01	<0.01
Selenium	0.043	0.02	0.009	0.023	0.006	<0.001	<0.001	<0.002	<0.005	0.002	<0.002
Zinc	0.189	0.077	<0.005	0.013	NT	0.028	<0.005	<0.005	NT	<0.005	0.009
Gross Alpha (pCi/l)	84	28	19	78	22	21	44	52	22	14	10
Gross Beta (pCi/l)	43	40	41	54	68	40	35	46	25	13	43
Radium-226 (pCi/l)	4.4	NT	3.3	0.8	2.4	36.0	2.0	2.6	4.3	5.2	2.6
Radium-228 (pCi/l)	--	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Thorium-230 (pCi/l)	1	NT	0.2	0.0	3.1	0.0	1.0	0.0	0.5	0.9	0.1
Natural Uranium	0.003	0.0035	0.0041	0.0064	0.0240	0.0036	0.0080	0.0057	0.0027	0.0042	0.0085

Notes:
1. Sample analytical results for total concentrations except where values are boxed. Boxed values are dissolved concentrations.
2. Concentrations report in mg/l except where noted.
3. Shaded values exceed the Maximum Groundwater Limits established in accordance with the Permit.
4. NT = Not tested.

TABLE 2.1

EXISTING WATER QUALITY DATA
HERMIT MINE SITE

Analyte	Maximum Groundwater Limit	Mining							Post-Mining						
		Well HER 044 6/29/89	Sump HER 043 6/29/89	Well HER 048 9/21/89	Sump HER 049 9/21/89	Well HER 051 10/19/89	Well HER 052 12/07/89	Sump HER 054 12/07/89	Well HER 061 3/29/90	Sump HER 059 3/29/90	Well HER 064 4/27/90	Well HER 065 5/31/90	Well HER 066 6/30/90	Well HER 069 7/31/90	Well HER 070 8/31/90
pH (pH unit)	6.85			6.92	6.69		7.29	7.35	6.98	7.74	8.06	7.15	7.1	7.28	6.69
Spec. Cond. (umhos/cm)	3555			3470	3820	3600	3470	3410	3330	3190	3318	3234	3400	3261	3360
Alkalinity	161			150	116		155		149	196	170	162	154	152	165.1
Carbonate	0					<1.0	<0.5	<0.5	<1.0		<1.0	<1.0	<1.0	<0.1	0.0
Bicarbonate	161			150	116	150	155	218	149	196	170	162	154	152	165.3
Chloride	44			40	38	39	52	30	38	30	NT	38	43	39	40
TDS	3615			3440	3530	3220	3310	3450	3430	3290	3320	3380	3440	3540	3390
TSS	107								59	11	93	42	44	67	NT
Nitrate as N	0.8		12.8	<0.1	31.4	<0.1	<0.1	51.3	<0.1	6.0	<0.1	<0.1	<0.1	<0.1	<0.1
Phosphate as P	0			<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	0.3	<0.1	<0.1	0.2	0.3
Sulfate	2425			2280	2300	2280	2280	2250	2290	2180	1150	2240	2310	2250	2300
Silica	14.3			11.5	11.2	9.8	8.9	10.1	D	9.9	D	D	D	D	NT
Calcium	620			542	521	547	466	537	D	513	D	D	D	D	549
Magnesium	199			186	187	210	155	170	D	168	D	D	D	D	178
Potassium	28.7			24.2	36.1	31.6	44.5	31.8	D	27.5	D	D	D	D	20.7
Sodium	85.7			76	97.8	102	NT	82	D	76.6	D	D	D	D	70.7
Flouride	1.53			1.28	1.35	1.43	1.3	1.3	1.4	1.1	1.4	1.2	1.2	D	1.4
Arsenic	0.024	0.004	1.09	0.008	0.530	0.022	0.008	0.205	D	0.266	D	D	D	D	<0.001
Barium	0.06	0.02	0.03	0.02	0.01	0.01	0.02	0.02	D	<0.01	D	D	D	D	0.17
Cadmium	0.027	0.006	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	D	<0.005	D	D	D	D	<0.005
Chromium	0.21			<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.04	0.02	0.04	<0.01	0.02	<0.01	0.02	0.03	D	<0.01	D	D	D	D	<0.01
Iron	11.21	12.0	0.29	11.6	0.25	4.71	1.13	0.19	D	0.11	D	D	D	D	12.4
Lead	0.16	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	0.03	D	0.04	D	D	D	D	<0.02
Manganese	0.19	0.23	0.08	0.49	0.08	0.3900	0.25	0.06	D	0.04	D	D	D	D	0.19
Mercury	0.002	<0.0002	0.0002	0.009	<0.0002	<0.0002	0.0002	0.0005	D	<0.0002	D	D	D	D	<0.0002
Silver	0.03	<0.01	<0.01	<0.0002	0.02	0.0230			D	0.01	D	D	D	D	<0.002
Selenium	0.043	0.020	0.042	<0.01	0.017	<0.01	0.006	0.010	D	0.008	D	D	D	D	<0.01
Zinc	0.189	0.077	0.123	<0.005	0.156	0.013	NT	0.093	D	0.094	D	D	D	D	0.009
Gross Alpha (pCi/l)	84	28	4000	19	29800	78	22	104000	21	5500	44	52	22	14	10
Gross Beta (pCi/l)	43	40	1100	41	10100	54	68	44900	40	1190	35	46	25	13	43
Radium-226 (pCi/l)	4.4			3.3	60	0.8	2.4	7800	36	210	2.0	2.6	4.3	5.2	2.6
Radium-228 (pCi/l)	-														
Thorium-230 (pCi/l)	1.0			0.2	710	0.0	3.1	5900	0.0	0.5	1.0	0.0	0.5	0.9	0.1
Natural Uranium	0.003	0.0035	3.31	0.0041	18.4	0.0064	0.0240	36.6	0.0036	4.29	0.0080	0.0057	0.0027	0.0042	0.0085

Notes:
1. Sample analytical results for total concentrations except where noted.
2. Concentrations report in mg/l except where noted.
3. Shaded values exceed the Maximum Groundwater Limits established in accordance with the Permit.
4. NT = Not tested.
5. D = Analyzed for dissolved concentrations.

TABLE 2.2

CONCENTRATIONS OF TOTAL SUSPENDED SOLIDS
HERMIT MINE SITE MONITOR WELL

Pre-Mining

Sample	Date	Concentration (mg/l)
HER-012	4/28/88	18
HER-025	6/29/88	14
HER-032	12/23/88	9
Jan-Feb 1989: EFN personnel first observed sediment in water, red color		
HER-041	5/31/89	88

Post-Mining

HER-061	3/29/90	59
HER-064	4/27/90	93
HER-065	5/31/90	42
HER-066	6/30/90	44
HER-069	7/31/90	67

Mine shaft was being sunk

TABLE 2.3

EXCEEDANCES RELATED TO PURGE VOLUME

Purge Volume	3 Casings	1 Casing
Analytes	Number of MGL Exceedances/Total Number of Analyses	Number of MGL Exceedances/Total Number of Analyses
pH	0/3	0/5
Spec.Cond.	0/3	1/9
Alkalinity	0/3	3/8
Carbonate	0/3	0/6
Bicarbonate	0/3	3/9
Chlorite	0/3	1/8
TDS	0/3	0/9
TSS	0/3	5/5
Nitrate-as N	0/3	0/9
Phosphate-as P	0/3	4/9
Sulfate	0/3	0/9
Silica	0/3	0/3
Calcium	0/3	0/4
Magnesium	0/3	1/4
Potassium	0/3	2/4
Sodium	0/3	1/3
Fluoride	0/3	0/8
Arsenic	0/3	0/5
Barium	0/3	1/5
Cadmium	0/3	0/5
Chromium	0/3	0/9
Copper	0/3	0/5
Iron	0/3	3/5
Lead	0/3	0/5
Manganase	0/3	4/5
Mercury	0/3	0/5
Silver	0/3	0/4
Selenium	0/3	0/5
Zinc	0/3	0/4
Gross Alpha	0/3	0/10
Gross Beta	2/3	3/10
Radium-226	0/3	2/9
Radium-228		
Thorium-230	0/3	1/9
Natural Uranium	0/3	9/10

Notes:

1. Analytes with exceedances of the MGLs are shaded.
2. MGL is the Maximum Groundwater Limit established in accordance with the Permit.

TABLE 2.4

ANALYTES FOR LABORATORY QA/QC PROGRAM

Analytes	Sample Type: Spike and Spike Replicates	Sample Type: Ground Water Replicates	Sample Type: Blank
Major Ions			
pH		X	X
Spec.Cond.		X	X
Alkalinity		X	X
Carbonate		X	X
Bicarbonate		X	X
Chloride	X	X	X
TDS	X	X	X
TSS		X	X
Nitrate-as N		X	X
Phosphate-as P		X	X
Sulfate	X	X	X
Silica		X	X
Calcium		X	X
Magnesium		X	X
Potassium	X	X	X
Sodium	X	X	X
Fluoride		X	X
Metals			
Arsenic		X	X
Barium		X	X
Cadmium		X	X
Chromium	X	X	X
Copper		X	X
Iron	X	X	X
Lead		X	X
Manganase	X	X	X
Mercury		X	X
Silver		X	X
Selenium		X	X
Zinc	X	X	X
Radionuclides			
Gross Alpha	X	X	X
Gross Beta		X	X
Radium-226		X	X
Radium-228		X	X
Thorium-230		X	X
Natural Uranium	X	X	X

TABLE 2.5

SPIKE SAMPLE RESULTS FOR ACCURACY ASSESSMENT

	Unit of Measure	Spike Value	Spike Sample No.1 (HER 078) Reported Value	RPD	Spike Sample No.2 (HER 079) Reported Value	RPD	Spike Sample No.3 (HER 080) Reported Value	RPD
Major Ions								
Chloride	mg/l	50.00	52.00	4.0	53.00	6.0	53.00	6.0
TDS	mg/l	1562.00	1500.00	4.0	1490.00	4.6	1490.00	4.6
Sulfate	mg/l	1000.00	1040.00	4.0	1020.00	2.0	1030.00	3.0
Potassium	mg/l	50.00	46.80	6.4	45.40	9.2	45.90	8.2
Sodium	mg/l	100.00	100.00	0.0	97.60	2.4	97.10	2.9
Metals								
Chromium	mg/l	0.10	0.10	0.0	0.10	0.0	0.10	0.0
Iron	mg/l	10.00	9.32	6.8	9.11	8.9	9.15	8.5
Manganase	mg/l	0.30	0.33	10.0	0.32	6.7	0.33	10.0
Zinc	mg/l	0.25	0.343	100.0	0.327	100.0	0.360	100.0
Radionuclides								
Gross Alpha	pCi/l	27.08	13 +/- 5	52.0	15 +/- 4	44.6	15 +/- 4	44.6
Natural Uranium	mg/l	0.0400	0.0396	1.0	0.0385	3.8	0.0382	4.5

Notes:

1. RPD = Relative percent difference.
2. Shaded values are unacceptable accuracy.

TABLE 2.6

COMPARISON OF LABORATORY ACCURACY

This is lab EF used

	Unit of Measure	Spike Value	AccuLabs Reported Value	AccuLabs RPD	Barringer Reported Value	Barringer RPD
Major Ions						
Chloride	mg/l	50.00	54.00	8.00	52.67	5.33
TDS	mg/l	1562.00	1500.00	3.97	1493.33	4.40
Sulfate	mg/l	1000.00	700.00	30.00	1030.00	3.00
Potassium	mg/l	50.00	51.00	2.00	46.03	7.93
Sodium	mg/l	100.00	93.00	7.00	98.23	1.77
Metals						
Chromium	mg/l	0.10	0.10	0.00	0.10	0.00
Iron	mg/l	10.00	9.10	9.00	9.19	8.07
Manganase	mg/l	0.30	0.33	10.00	0.33	8.90
Zinc	mg/l	0.25	0.280	100.00	0.343	37.33
Radionuclides						
Gross Alpha	pCi/l	27.08	26.5	2.14	14.3	47.07
Natural Uranium	mg/l	0.0400	0.046	15.0	0.0388	3.10

Notes:

1. RPD = Relative percent difference.
2. Shaded values represent unacceptable accuracy.
3. Reported value for Barringer is the average of the three replicate sample values listed in Table 2.5.

TABLE 2.7

REPLICATE SAMPLE RESULTS USED IN
PRECISION EVALUATION

	Spike Sample Replicates				Ground Water Sample Replicates			
	HER 078	HER 079	HER 080	CV	HER 073	HER 074	HER 075	CV
pH (pH unit)					7.38	7.38	7.45	0.55
Spec.Cond. (umhos/cm)					3,470	3,380	3,380	1.52
Alkalinity					161.00	161.00	157.00	1.45
Carbonate					<1	<1	<1	NA
Bicarbonate					161.00	161.00	157.00	1.45
Chloride	52.00	53.00	53.00	1.10	40.00	40.00	40.00	0.00
TDS	1500	1490	1490	0.39	3,380.00	3,360.00	3,330.00	0.75
TSS					<4	<4	<4	NA
Nitrate-as N					<0.1	<0.1	<0.1	NA
Phosphate-as P					<0.1	<0.1	<0.1	NA
Sulfate	1040.00	1020.00	1030.00	0.97	1,830.00	2,240.00	2,250.00	11.38
Silica					13.00	12.70	13.20	1.94
Calcium					525.00	512.00	524.00	1.39
Magnasium					177.00	171.00	175.00	1.75
Potassium	46.80	45.40	45.90	1.54	20.10	19.70	20.00	1.04
Sodium	100	97.60	97.10	1.58	78.10	74.50	76.90	2.40
Flouride					1.50	1.50	1.50	0.00
Arsenic					0.002	0.002	0.002	0.00
Barium					0.01	0.01	0.01	0.00
Cadmium					<0.005	<0.005	<0.005	NA
Chromium	0.10	0.10	0.10	0.00	<0.01	<0.01	<0.01	NA
Copper					<0.01	<0.01	<0.01	NA
Iron	9.32	9.11	9.15	1.21	9.47	9.29	10.40	6.13
Lead					<0.02	<0.02	<0.02	NA
Manganase	0.33	0.32	0.33	1.77	0.12	0.12	0.12	0.00
Mercury					<0.0002	<0.0002	<0.0002	NA
Silver					0.01	<0.01	0.01	NA
Selenium					<0.002	<0.002	<0.002	NA
Zinc	0.343	0.327	0.360	4.81	0.111	0.175	0.105	29.77
	Error	Error	Error		Error	Error	Error	
Gross Alpha (pCi/l)	13 +/- 5	15 +/- 4	15 +/- 4	8.06	58.00 +/- 26	62.00 +/- 26	46.00 +/- 24	15.05
Gross Beta (pCi/l)	51 +/- 4	54 +/- 4	53 +/- 4	2.90	48.00 +/- 14	35.00 +/- 13	46.00 +/- 14	16.28
Radium-226 (pCi/l)					3.20 +/- 0.6	2.10 +/- 0.5	2.10 +/- 0.5	25.75
Radium-228 (pCi/l)					1.50 +/- 1.3	0.80 +/- 0.8	1.60 +/- 0.8	33.53
Thorium-230 (pCi/l)					0.00 +/- 0.5	0.40 +/- 0.6	0.20 +/- 0.5	100.00
Natural Uranium	0.0396	0.0385	0.0382	1.90	0.0009	0.0011	0.0010	10.00

Notes:
1. CV = coefficient of variation.
2. NA = Not applicable (precision analyses were only performed for analytes showing detectable concentrations).
3. Concentrations reported in mg/l except where noted.
4. Error is the counting error at the 95 percent confidence level.

TABLE 2.8

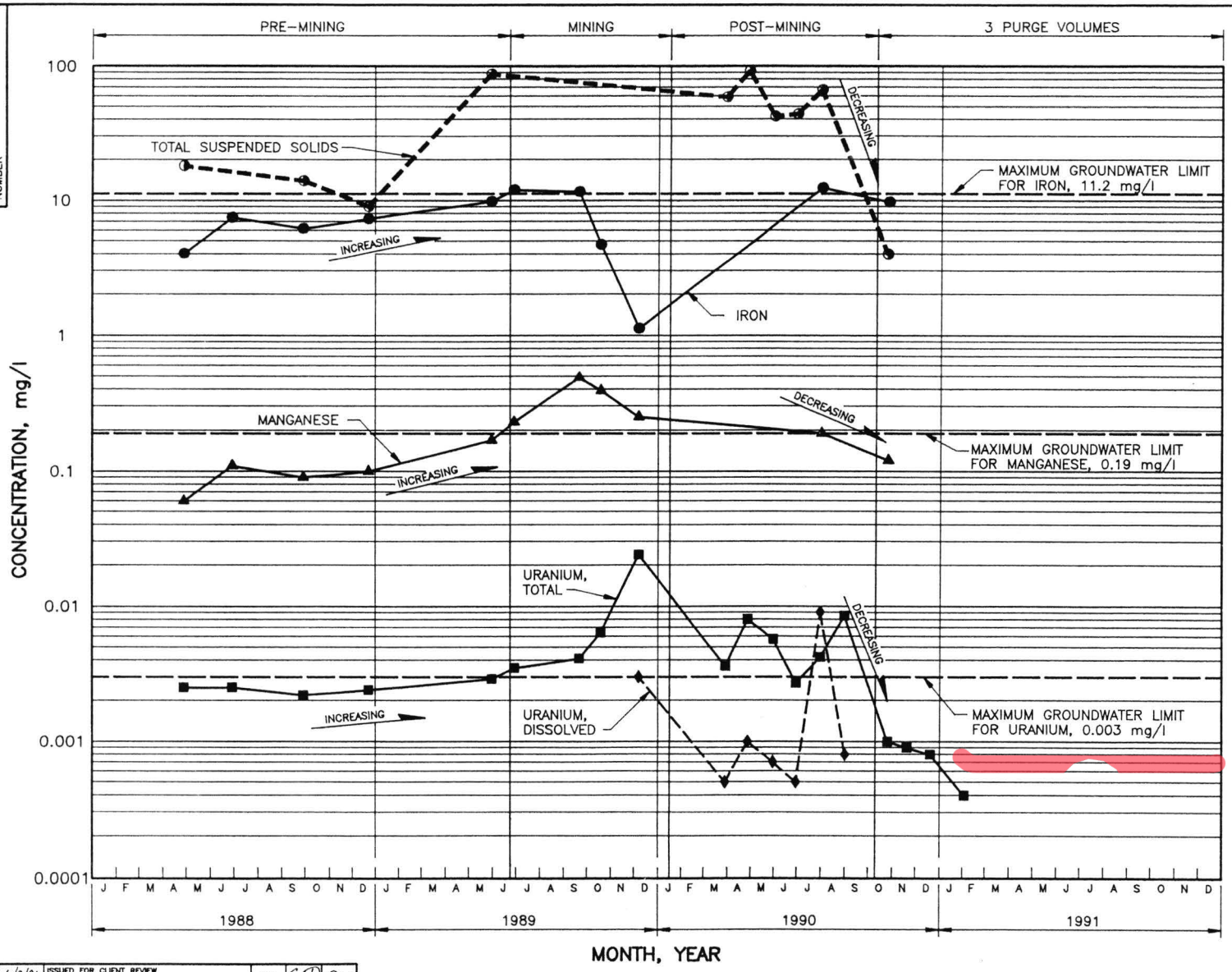
FIELD AND TRIP BLANK ANALYTICAL RESULTS

	Unit of Measure	Field Blank HER 076	Trip Blank HER 077
pH	pH unit	5.79	7.92
Spec.Cond.	umhos/cm	2.84	275.00
Alkalinity	mg/l	<1	90.00
Carbonate	mg/l	<1	<1
Bicarbonate	mg/l	<1	90.00
Chloride	mg/l	2.00	9.00
TDS	mg/l	<4	102.00
TSS	mg/l	<4	<4
Nitrate-as N	mg/l	<0.1	<0.1
Phosphate-as P	mg/l	<0.1	<0.1
Sulfate	mg/l	<4	28.40
Silica	mg/l	7.94	1.46
Calcium	mg/l	32.50	0.12
Magnasium	mg/l	8.07	0.02
Potassium	mg/l	1.70	<0.5
Sodium	mg/l	6.72	0.23
Flouride	mg/l	<0.1	0.10
Arsenic	mg/l	<0.001	<0.001
Barium	mg/l	0.04	<0.01
Cadmium	mg/l	<0.005	<0.005
Chromium	mg/l	<0.01	<0.01
Copper	mg/l	<0.01	<0.01
Iron	mg/l	0.03	0.02
Lead	mg/l	<0.02	<0.02
Manganase	mg/l	<0.01	<0.01
Mercury	mg/l	0.0007	<0.0002
Silver	mg/l	<0.01	<0.01
Selenium	mg/l	<0.002	<0.002
Zinc	mg/l	0.108	0.100
Gross Alpha	pCi/l	0.00	<0.20
Gross Beta	pCi/l	<0.90	3.20
Radium-226	pCi/l	<0.20	0.00
Radium-228	pCi/l	1.10	1.10
Thorium-230	pCi/l	0.00	0.00
Natural Uranium	mg/l	0.0008	<0.0003

Note: Nondetect and zero values are shaded.

FIGURES

DRAWING NUMBER 90-275-B5



0.030 not 0.003 mg/L

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	6/3/91	ISSUED FOR CLIENT REVIEW	R.H.		

WATER QUALITY TRENDS

PREPARED FOR

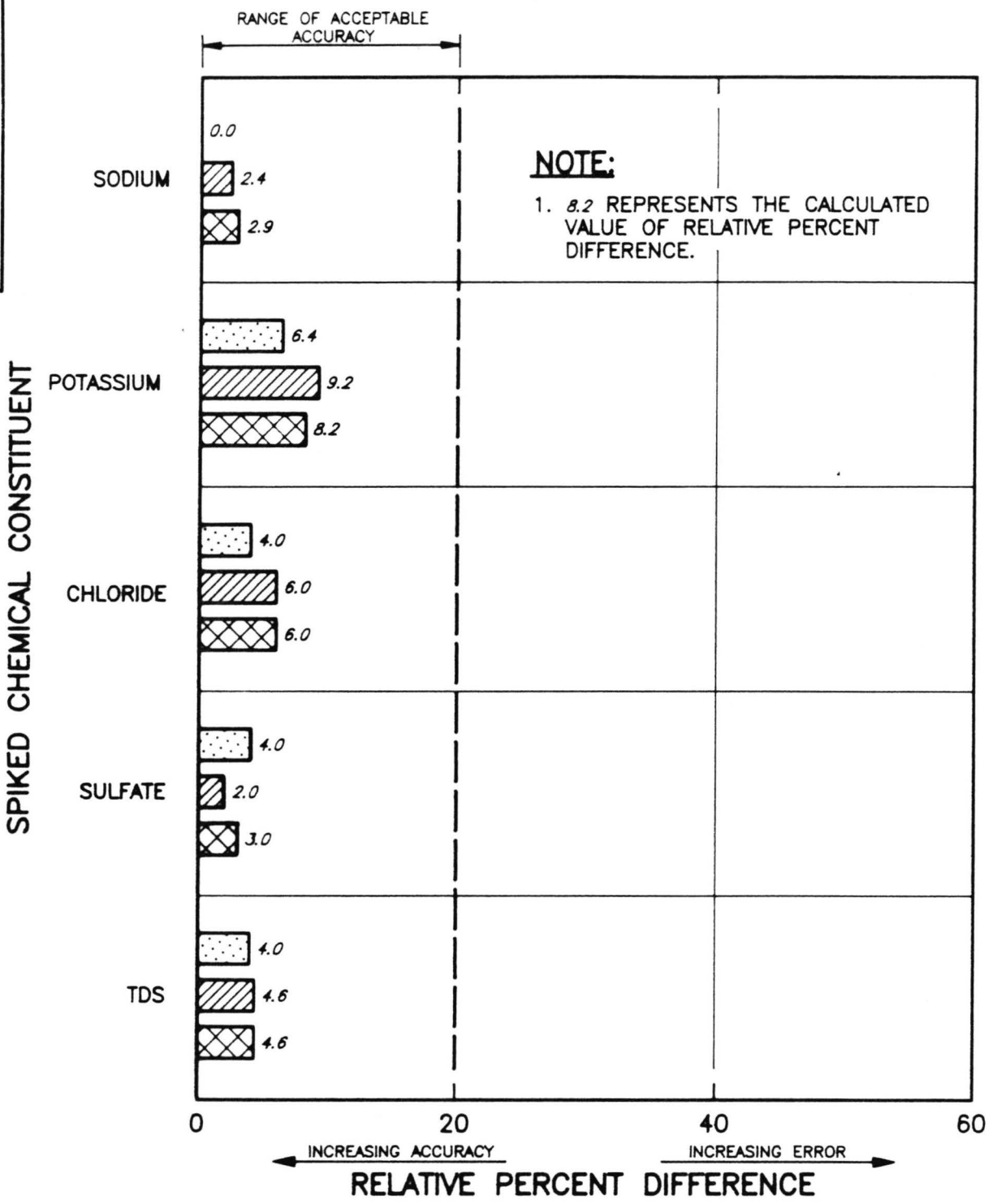
ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

Canonie Environmental

DATE: 4-19-91	FIGURE 2-1	DRAWING NUMBER 90-275-B5
SCALE: AS SHOWN		

1

DRAWING NUMBER 90-275-A1



LEGEND:

- SPIKE REPLICATE SAMPLE NUMBER 1
- SPIKE REPLICATE SAMPLE NUMBER 2
- SPIKE REPLICATE SAMPLE NUMBER 3

LABORATORY ACCURACY BY CONSTITUENT (IONS)
HERMIT MINE SITE

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

Canonie Environmental

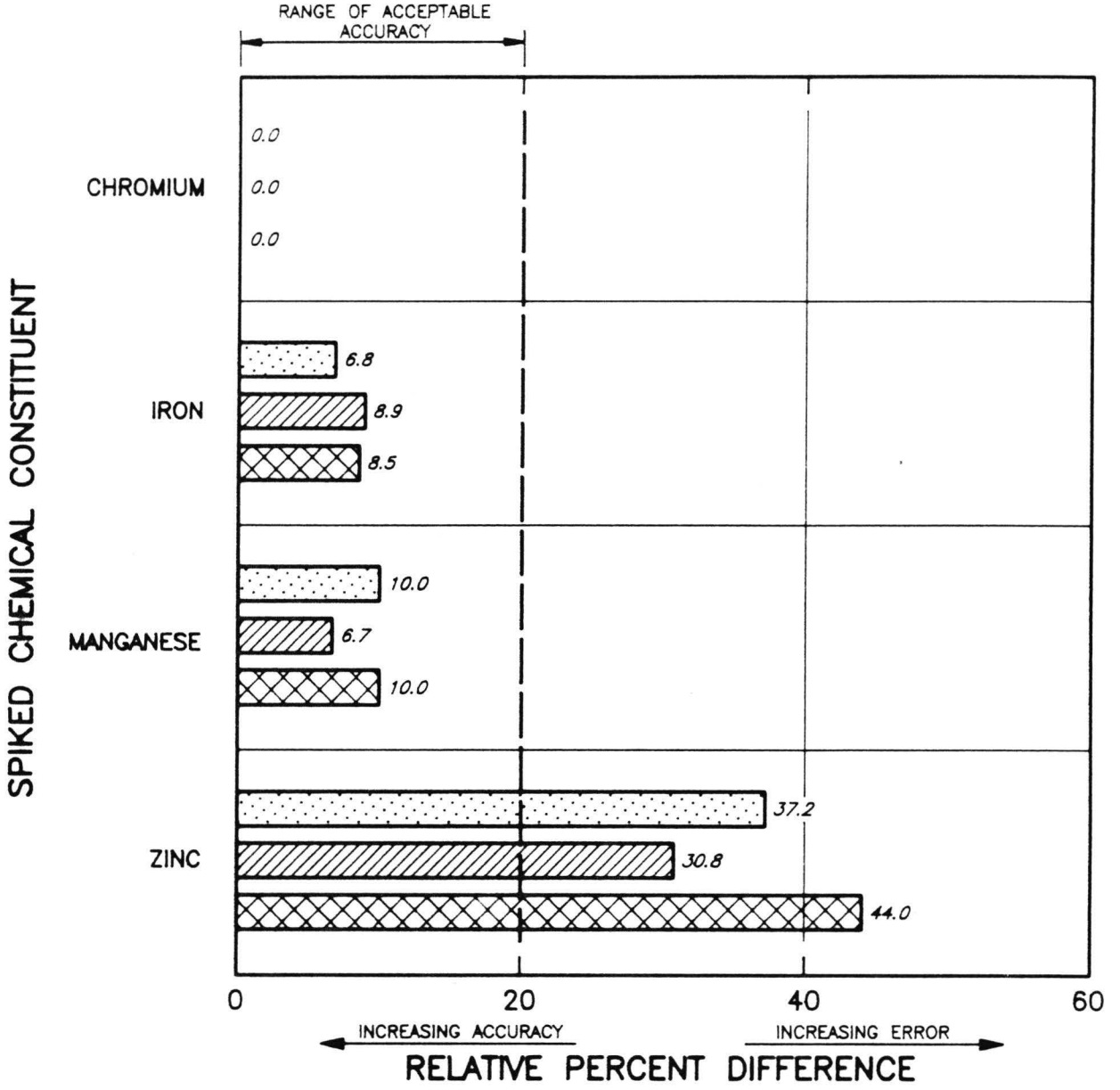
No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	6/3/91	ISSUED FOR CLIENT REVIEW	M.B.H.		

DATE: 1-21-91
SCALE: AS SHOWN

FIGURE 2-2

DRAWING NUMBER 90-275-A1

DRAWING NUMBER 90-275-A2



NOTE:

1. *8.9* REPRESENTS THE CALCULATED VALUE OF RELATIVE PERCENT DIFFERENCE.

LEGEND:

- SPIKE REPLICATE SAMPLE NUMBER 1
- SPIKE REPLICATE SAMPLE NUMBER 2
- SPIKE REPLICATE SAMPLE NUMBER 3

LABORATORY ACCURACY BY CONSTITUENT (METALS)
HERMIT MINE SITE
PREPARED FOR
ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

Canonie Environmental

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	6/5/91	ISSUED FOR CLIENT REVIEW	M.B.H.		

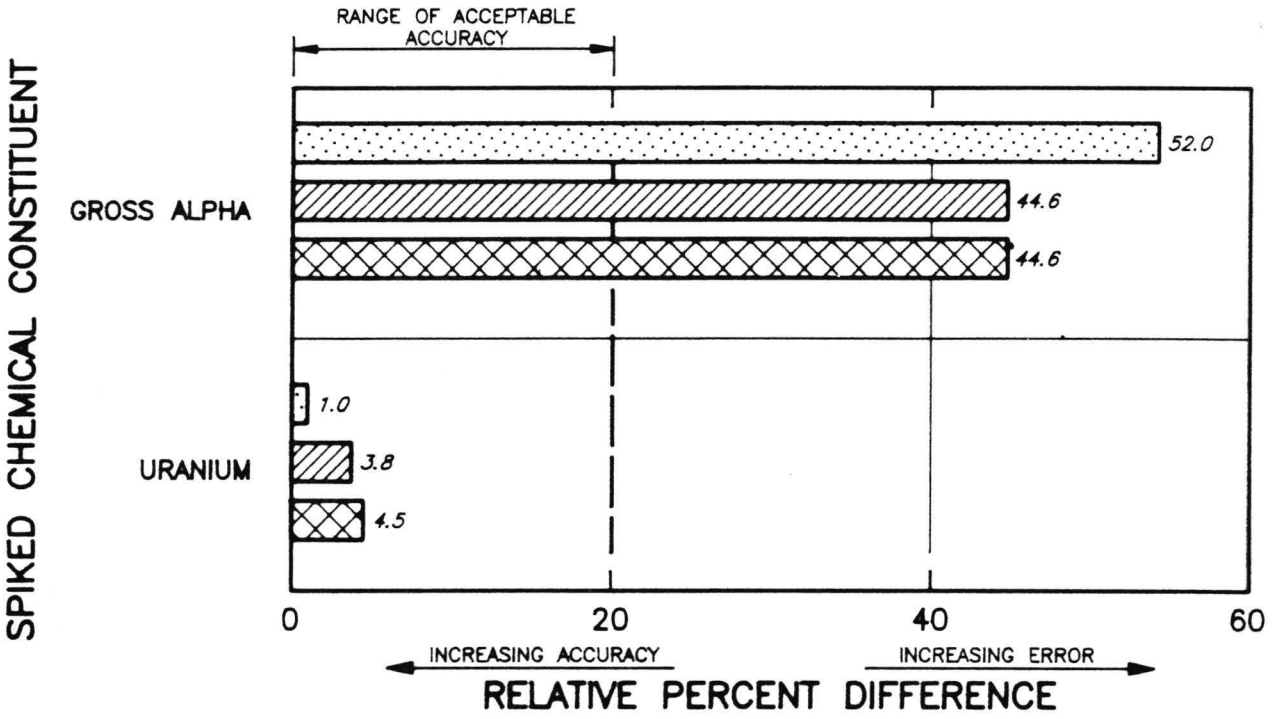
DATE: 1-21-91
SCALE: AS SHOWN

FIGURE 2-3

DRAWING NUMBER 90-275-A2

1

DRAWING NUMBER 90-275-A3



NOTE:

1. *3.8* REPRESENTS THE CALCULATED VALUE OF RELATIVE PERCENT DIFFERENCE.

LEGEND:

- SPIKE REPLICATE SAMPLE NUMBER 1
- SPIKE REPLICATE SAMPLE NUMBER 2
- SPIKE REPLICATE SAMPLE NUMBER 3

LABORATORY ACCURACY BY CONSTITUENT (RADIONUCLIDES)
HERMIT MINE SITE

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

Canonie Environmental

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	6/3/91	ISSUED FOR CLIENT REVIEW	M.B.H.	SHP	RJP

DATE: 1-21-91
SCALE: AS SHOWN

FIGURE 2-4

DRAWING NUMBER 90-275-A3